DOCUMENT RESUME

ED 046 104 EA 003 228

AUTHOR	Oddie, Guy; McDowall, David
TITLE	Development and Economy in Educational Building in Greece, Portugal, Spain, Turkey and Yugoslavia. Report on OECD Project.
INSTITUTION	Organisation for Economic Cooperation and Development, Paris (France).
PUB DATE	68
NOTE	131p.
AVAILABLE FROM	O.E.C.D. Publications Center, Suite 1305, 1750 Pennsylvania Avenue, N.W., Washington, D.C. 20006. (91-68-01-1, $2.50.)
EDRS PRICE	EDRS Price MF-$0.65 HC-$6.58
DESCRIPTORS	*Construction Costs, Construction Programs, Economics, *Educational Facilities, *Educational Finance, Educational Policy, Foreign Countries, *Resource Allocations, School Space

ABSTRACT

Five Mediterranean countries conducted a 2-year survey of their school building projects to find solutions to the financial, functional, technological, and administrative problems that had arisen in the course of expanding national educational services. This resulting report provides only general recommendations inasmuch as the individual cultural pattern of each country precluded the advancement of one single set of solutions. The three major recommendations were (1) to reduce disparities between working conditions and costs by establishing minimum standards for several educational parameters and by allocating resources accordingly, (2) to allow no construction projects to begin until all financing arrangements have been completed, and (3) to strengthen national coordination between project planning and resource allocation. (Figures 5(1) and 5(2) on pages 58 and 59 may reproduce poorly in hardcopy.) (RA)

ED0 46104

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REPORT ON THE OECD PROJECT

development and economy
in
educational building

IN GREECE, PORTUGAL, SPAIN, TURKEY AND YUGOSLAVIA

EA 003 228

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CO-OPERATION AND DEVELOPMENT

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FOREWORD

The project concerned with Development and Economy in Educational Building, known as the DEEB Project, was sponsored by the OECD Committee for Scientific and Technical Personnel as part of its integrated approach to educational development, of which effective resource utilisation forms one important facet. This project was initiated in 1963/64 by agreements with the Governments of Greece, Portugal, Spain, Turkey and Yugoslavia. It represents an attempt by national teams, set up by the participating countries and financed jointly by the Governments concerned and the Organisation's Technical Assistance Programme, to identify the measures necessary for securing the most efficient use of school building resources in the light of national targets for educational expansion and of national economic circumstances.

The present volume summarises and comments on the major conclusions and recommendations resulting from the project. It is based on the individual country reports prepared by the teams, all of which have now been submitted to the national authorities concerned. Since each of these reports is of considerable length and much of its content relates solely to a specific national situation, it is not intended to publish any of them separately. Much of the experience derived from the project is, however, of wider value and the present report is therefore an attempt to abstract from this experience the major features which would seem to be of general application, not only in the participating countries but elsewhere. As such it is complementary to the study published by OECD in 1966 under the title of

School Building Resources and their Effective Use.

The report confirms the value of the project to the participating countries but clearly shows that the work done under the terms of the project represents only the start of a process which has to be continued vigorously and purposefully if the school needs of the participating countries are to be successfully met. It emphasises that this can only be done if new and permanent institutional arrangements are set up for this specific purpose.

The problems encountered in the course of the project, as shown in the report, are simply an acute form of those common to most countries expanding and developing their educational systems. Thus the DEEB Project may be seen as a prototype for extending co-operation in school building topics to a wider international field. The need and importance of such co-operation has already been endorsed in the programmes of the Committee for Scientific and Technical Personnel which provide for further detailed work in this area, particularly in connection with the international exchange of research and development work as stipulated in the Resolution on school building passed by the Fifth Conference of European Ministers of Education. In this wider context, the present report makes a valuable contribution in so far as it highlights a number of important implications for international activity in school building.

The report has been prepared by Guy Oddie of the U.K. Department of Education and Science, in his capacity as consultant to OECD, with the valuable assistance of David McDowall of the same Department in the compilation of the statistical material used. In recording the Organisation's appreciation for their work, particular commendation should be made of the comprehensive way in which the author has brought together the many issues and concepts covered to show how educational aims, available resources and the means and methods of implementation interact in any policy aiming at securing the effective use of school building resources.

CHAPTER I : INTRODUCTION

Origins

1. OECD interest in school building dates from 1962. In that year the Organisation as part of the programme of its Committee for Scientific and Technical Personnel initiated its Mediterranean Regional Project (MRP) in which the developing countries of southern Europe-Greece, Italy, Spain, Portugal, Turkey and Yugoslavia - set out to establish overall targets for educational expansion in the light of each country's economic and social objectives. From the earliest stage of this Project it was evident that the expansion required would impose a major effort in the field of school building which was likely to strain resources to the limit. In the same year, an International School Building Conference was held in London under the auspices of UNESCO which drew attention to several new approaches to educational building problems. Recognising the value of these new approaches the Organisation decided to explore how they might best be applied in enabling MRP countries to make the most effective use of the school building resources available to them. To this end preliminary surveys were then carried out in each of the countries concerned and recommendations made accordingly.

2. The surveys were carried out by pairs of experts, each of which consisted of a building technologist from the Bouwcentrum in Rotterdam, and a senior administrator from the United Kingdom Ministry of Education (now the Department of Education and Science), engaged temporarily for the specific task as consultants to the Organisation. In the light of these surveys a proposal was endorsed by the Organisation for a Project in the Mediterranean Region to be concerned with the development and economy in educational building, and known for convenience as the DEEB Project.

3. The project was conceived as part of an integrated approach which characterises OECD consideration of educational development as a whole, an approach in which targets, resources and means of implementation interact dynamically and continuously upon each other. In such a context school building occupies a mid-way position. While the existing stock of schools constitutes in itself an important

resource, its maintenance, replacement and expansion make a claim on resources against which other claims compete. At the same time, developments in educational structure, in curriculum and in teaching method will call for corresponding innovation and development in the kinds of school which are built. Here again, cost and technological feasibility may constitute important constraints on the rate at which expansion can proceed and at which innovations may be introduced ; and it is because such questions of educational development are inseparable from questions of economical resource use that the words "development" and "economy" are associated in the name of the project.

Objectives

4. The objectives of the project, broadly speaking, have been to seek satisfactory solutions to the financial, functional, technological and administrative problems raised by school building in the light of the effective and economic implementation of the national school building expansion requirements. In order to restrict the project to manageable dimensions the consideration of building for higher education was excluded.

5. This search for the most effective use of resources in the face of pressures from educational expansion naturally tended to lay great emphasis on a reduction of costs, but it was recognised at the outset of the project that costs cannot be separated from standards. Similarly, where standards concern the quantity or the quality of accomodation, they in turn are inseparable from consideration of educational aims, of teaching methods and techniques. For this reason it was decided to pay particular attention to the scale of accommodation and standards of physical performance appropriate to each type of educational establishment within each of the national systems examined.

6. A further objective of the project was to establish what levels of expenditure were necessary to provide schools to the standards of accommodation recommended in the light of the research conducted and to draw attention, also, to the design and construction implications inherent in providing such standards within such levels of expenditure.

7. Finally, in view of the close connection between the use of school building resources and the administrative mechanisms responsible for implementing national school building investment programmes, the project included among its objectives that of considering where overhaul of such machinery would show advantages.

8. At no time was the project intended to produce either firm investment plans or firm proposals for the size, type and location of the schools such investment would provide. The aim, which broadly speaking has been achieved, was rather to identify the significant features of school construction which would affect such plans and the measures needed to give them practical effect in terms of real buildings.

National teams

9. For the implementation of the project, the Organisation sponsored in each country the formation of national teams to study the problems involved and make recommendations accordingly. Agreements to this effect were concluded in 1963 with Portugal, Spain and Yugoslavia, and in 1964 with Greece and Turkey.

10. It was decided that the teams should consist solely of nationals from the country concerned. They would thus be in a better position than visiting experts to understand the subtleties of national circumstances, and the results of their work would have a more immediate impact on educational building policies. Nevertheless, as part of the agreements OECD has made available foreign technical assistance where it was found to be helpful and since October 1963, the project has had guidance and assistance from a full-time consultant with extensive experience in the technological, financial and institutional aspects of school and university construction.

11. The Organisation tried to ensure that each essential feature of the national team contained a balance of all, (or most) of the specialists concerned in the effective execution of a school building programme, that is to say, educationists, administrators designers, (architects, engineers and/or building cost experts), while in some cases, an economist has been associated with the team as well.

12. The term "educationist" means, in the sense used here, someone who is familiar with the broad strategics and objectives of educational development, but who, at the same time, is familiar with the daily problems of practical teaching and with any current innovations which attempt to solve them. The term "administrator" on the other hand, means the kind of person to whom the execution of Government policy is delegated from a Ministerial level, who designs the administrative framework and controls and supervises its operation and who can say, therefore, how proposed innovations may affect or be affected by government policy or what modifications to governmental procedures their

adoption may demand. His role is to see the work of the team in the context of the wider complex of Government administration, to ensure that the approach to standards, costs and organisational problems is realistic and relevant and to assist in interpreting the work of the team to all those interested in it or affected by it.

Duration

13. With one exception dictated by special circumstances, the duration of the project was limited to two years, by the end of which time the main objectives were to be explored and a report prepared and submitted to Governments.

14. To cover the two-year period a provisional budget for each team was fixed at 250,000 French francs, to which the Organisation (under its Technical Assistance Programme) and the Government concerned were to make matching contributions subject to an upper limit of 125,000 francs from the Organisation. In some cases this limit has not been reached. In other cases the provisional budget has been exceeded and the Government concerned has considered it desirable to meet the whole of the excess. On average, however, it may be said that the original budget forecasts have been confirmed. Besides salaries and wages (or fees for occasional expert services), the budget included items for expenses incurred by the team on travel inside their own country, as well as an item for translation and documentation.

15. In addition to its budget contribution, the Organisation has provided the technical assistance mentioned in para. 10 above and met the cost of three working meetings held in the course of the project, including the travel and subsistence of the two or three representatives attending the meetings on behalf of each team. Participating governments, for their part, have provided premises and equipment for the teams and met the cost of overheads.

16. The manpower composition of the teams which the budgets permitted varied considerably from one country to another, but by and large each team consisted of a director with a core of architects or engineers for whom the project was their principal if not their full-time occupation. This core has been supplemented by educationists and administrators operating on a part-time but regular basis, and by other experts called in for special purposes, as and when circumstances

required. Each team also incorporated technical and clerical assistants.

Working Methods

17. In September 1964 a working meeting of DEEB team representatives was held in London to discuss the detailed objectives and working methods of the project. At this meeting members of the U.K Department of Education and Science presented a number of papers which attempted to abstract some methodological principles from U.K. experience. As was expected, the subsequent course of the DEEB project raised new problems lying outside this experience and suggested new aspects of method and principle.

18. These topics formed the subject of detailed discussions between the teams and the OECD consultant advising them, which were held in the course of visits by the latter to the countries concerned. The project was divided broadly into three phases, survey of the existing situation, analysis of findings and formulation of proposals ; and where possible the visits took place at the beginning and in the middle of each phase. The visits and discussions were the main channel through which teams gained access to experience in other countries. Without the first-hand knowledge they afforded, the consultant adviser would have been wholly unable to appreciate how far such experience was relevant or could be made relevant to the problems facing the teams, or what methodological adaptation might be suggested for consideration.

19. The discussions also showed when additional expertise was required. This led to further visits by other expert consultants and in certain cases to research and investigation undertaken by the principal consultant on behalf of the teams. A noteworthy feature of the project has been its character as a kind of field laboratory generating research and testing hypotheses. Some of the methodological development it has stimulated has proved, in fact, to have far-reaching effects, some of which are still imperfectly understood and offer considerable scope for further investigation which is likely to benefit other countries as well as those who have participated in the project.

20. The fact that the project has had about it this pioneering experimental character means that within the limited duration set for it the teams were obliged to produce reports before entirely satisfactory techniques had been evolved. Further working meetings, one in

Paris in May 1965 and another, more technical, in Lisbon a year later, were held to examine methods and compare results. But it was not until reports had been virtually completed that it was possible for all the issues under investigation to be brought together and related to each other. This was done in the study prepared by the consultant to the project and published by OECD under the title of School Building Resources and Their effective Use, in the middle of 1966. This publication was an important by-product of the project and has been well received as the first comprehensive study of its subject Nevertheless its comparatively (and unavoidably) late appearance underlines the necessity imposed on the teams of developing suitable working methods, often by trial and error, as they went along this explains why teams have succeeded in covering only part of the field, why their results and recommendations must be regarded as interim only, and why the unsolved problems are even more numerous than those that have been solved. However, when the circumstances of the project are understood, the teams deserve credit for having achieved as much as they have in as short a time.

Operational Difficulties

21. The work of the project has to some extent been hampered by what can best be classified as operational difficulties, i.e. by difficulties caused by conditions under which the teams have been obliged to operate. First among these is the problem of part-time working. The problems of the investigation - often demanding long stays away from base - are such as to demand intensely concentrated effort over considerable stretches of time. Yet the architects and engineers from whom intense and prolonged concentration is most needed have not, for the most part, been able to work full-time on the project. Even in countries where such personnel are employed in the civil service, they usually have private practices of their own as well, while, in addition, shortage of professional skills in the civil service itself tends to increase the work load and the distractions to which such personnel are subject. Had they been members of large private practices of the size and character common in the USA or the UK, the architects and engineers who have formed the nucleus of each team could have devoted all their energies to the project with every assurance that other work would be waiting for them when their current assignment had been completed. But private practices of this size are rare, if they exist at all, in the DEEB countries so that any private practitioner devoting

himself full-time to the project would almost certainly put his future to risk.

22. Then both architects and educationists tended to share habits of thought which fail to recognise any but the most tenuous link between school buildings and the educational activity which takes place inside and around them. The reasons are probably numerous an hidden But the failure may in part be due to the fact that architects are so seldom required, or given the opportunities to watch educationists at work and partly to the fact that the link becomes most apparent in the detailed furnishing and fitting out of the school, which in the DEEB countries is often the responsibility of neither the architect nor the educationist and is sometimes neglected altogether. Again there seems often to be a great gulf between practising teachers on the one hand and officials responsible for educational policy on the other. It is the latter, if anyone, who brief the architects, and their interests tend to concentrate on the content of education rather than on the classroon techniques which must help pupils to benefit from it; but as will become evident from the chapters which follow, it is classroom techniques which determine what kind of a school should be provided and constitute the major constraint on any attempt to improve the utilisation of school building resources.

23. Finally, the role and potential of the administrator seems to be little appreciated in the DEEB countries, at any rate as far as educational building is concerned. His responsibility seems normally limited to the mechanical application of rules and procedures which themselves are designed primarily as safeguards against corruption or the misappropriation of funds. For an extensive programme of school building to be mounted and effectively carried out, administration needs to be conceived more positively, the task of the administrator being to devise new machinery for ensuring a steady flow of finance, for directing it into those channels for which priorities have been established, and for ensuring that it is used to produce real assets in the form of usable school buildings at the earliest possible moment.

24. This brief review will perhaps have shown that national authorities faced considerable problems, not always fully overcome, in recruiting suitable personnel; and that the teams, once formed, were obliged to cultivate new attitudes and habits of mind for themselves in the course of a project which has inevitably led them to cultivate such attitudes and habits in the minds of others.

Range of Studies

25. Each team found itself obliged to decide between attempting to cover the whole range of education below the level of university entry, or covering only part of the range, depending on the size of the problems in each case and on the team's resource for tackling them.

26. The Greek team, operating under the aegis of the Ministry of Co-ordination, attempted to cover the whole range of general primary and secondary education with a notable degree of success. Although the team emphasises that its proposals must be regarded as tentative and subject to revision after experience in implementing them, the data on which they are based are more complete than those of any other team, and provide the clearest possible guide to the whole complex of school building problems in Greece, to the further research and data collection still needed, and to the major measures necessary to improve the supply, quality and distribution of school buildings in that country. Indeed the comprehensiveness of the Greek report is such that it merits the widest study, not only by the Greek authorities themselves, but by any country faced with the problems of expanding education against the background of economic development.

27. The Portuguese team, set up by the Ministry of Public Works in conjunction with the Ministry of National Education, faced a situation where the arrangements for secondary education were under review in the light of a decision to raise the school-leaving age. All primary schools, on the other hand, with the exception of those in the cities of Lisbon and Oporto, conformed to a type plan which had been standardised some twenty years previously. For these reasons the team decided to turn its attention first to the needs of primary education and, after benefiting from experience so gained, turn to secondary education problems later. As with other countries the investigation has provided valuable data indicating the direction in which changes of planning, construction and administration need to be made. But the most distinctive feature of the Portuguese work has been to establish the close relationship which must exist between teaching activity and the space and equipment needed for it. This relationship has been given tangible form in a school which has been built and furnished to the designs of the team. All teams (except Turkey, where the circumstances were different) were invited to prepare drawings and detailed specifications on which a market price could be obtained for a "test school" or "école témoin" which

would bear witness to the validity of the team's proposals and provide experience from which further advances could be made. It is much to the credit of Portugal that they have actually built their école témoin and it is much to be hoped that towards the end of 1968, when the school will have been in operation for two years, the Portuguese authorities will produce a report on how it has functioned and the experience it has provided. A second école témoin for advanced primary education (ciclo observatorio) at Mafra has reached the stage of preliminary design. Much benefit would accrue to Portuguese educational building if the studies in this direction could be pursued to the same extent of building as in the primary school referred to.

28. In Spain, the provision of primary schools has received considerable attention in recent years, and while improvement in such schools can no doubt be made, the team decided to exclude this topic from its investigation and to concentrate instead on school building for general secondary education. By doing so the team has succeeded in showing first, how provision in this field may be made more efficient and economic, and secondly has established principles and developed techniques which are equally valid for other sectors of education, among which the technical and vocational should next receive attention from the team or its successor. The Spanish team also produced drawings and specifications for a remarkable école témoin, the estimated cost of which was so low that with no reduction in standards it was expected to accomodate 1200 pupils for a price formerly considered acceptable for 800. Unfortunately an unexpected change in educational policy caused the project to be abandoned. It is to be hoped that the Ministry of National Education, under whose aegis the team was set up, will find an early opportunity to erect a school in which the team may embody its proposals.

29. Yugoslavia differs from other countries participating in the project by virtue of its federal structure and national policy of decentralised authority. For this reason the team, although set up by the Federal Secretariat for Education and Culture, conducted its operations from Zagreb, administrative capital of the Croatian Republic. It concentrated its effort on the primary sector of education. The elementary school in Yugoslavia caters, however, for pupils up to 14 years old and includes a range of subjects which is wider and taken to a more advanced level than in other DEEB countries, so that the end of the elementary cycle corresponds more to the beginning of the

secondary cycle elsewhere. Much valuable work had already been carried out in this field by the national Pedagogical Standards Institute on whose work the team were able to build. For much of the two-year period the team worked on proposals directed towards a system of prefabrication. Although this, in itself proved abortive, it led on to proposals which are still being developed for a rationalised system of school construction conforming to an agreed discipline and based on work carried out in conjunction with the Secretariat for Education and Culture in the Republic of Slovenia. The success of the project has been limited, however, by the fact that the policy of the country in fact demands not one federally sponsored team, but separate teams in each republic.

30. Turkey has also been exceptional in that the preliminary survey suggested that school building needed to be investigated from an overall strategic viewpoint before valid proposals for specific action could be formulated. The team was located, therefore, in neither the Ministry of Works nor the Ministry of Education - the two executive departments with an interest in the subject - but in the State Planning Organisation. The result has been to amass a large quantity of data concerning the quantity and distribution of school facilities throughout the country, the extent to which costs vary with locality, the labour/material mix in school buildings, the availability and distribution of professional and constructional manpower, transport, etc. An attempt has also been made to examine and propose standards of area and performance, but this examination needs to be carried much further before any proposals related to them can be regarded as valid. The main value of the Turkish project lies in the mass of information collected and brought together for the first time and in which it will now be necessary to quarry in the search for solutions to the formidable school building problems which the country faces. References to "all countries" in the present report must, because of the exceptional circumstances, be regarded as excluding Turkey unless otherwise specifically stated.

The Project as an Educational Indicator

31. Not the least striking feature of the project is the light it has cast on educational conditions as a whole. A few examples will make the point.

32. 9,600 villages out of a total of 36,000 Turkish settlements (1960 census) have no school at all - over 25%. In Greece, 56% of the school population are crowded into 29% of the available accomodation. Such facts not only dramatise, but help to quantify inequalities in educational opportunity.

33. In Greece again - nearly 80% of secondary schools have neither slide nor ciné projector, and over 84% are inadequately equipped for science teaching, while for physics, chemistry and biology respectively, 23%, 32% and 49% have no science teaching aids whatever. Out of 280 state-owned lycea, 230 have no science room. This observation is not intended to single out one country for its deficiencies; it is simply that the commendable thoroughness of the Greek survey has enabled the situation to be seen more clearly in Greece than elsewhere. Nevertheless, that such a situation can exist in the country to which so many streams of modern scientific thought can trace their origins illustrates at once the problems which result from a shortage of ressources; more than that, it suggests that a survey of school facilities may well be a useful indicator of the quality as well as of the quantity of education which a country is able to provide.

Major Topics of the Project

34. Clearly any study of national school building problems must begin by asking what kind of schools are needed to meet the needs of each sector of the educational system. Sometimes the teams have not found an answer readily forthcoming and the close link between school building and educational policy has been thrown immediately into sharp relief. But in any case no progress is possible unless the question can be answered, and thus the first main topic is that of Standards. Only when standards have been studied and defined is it possible to consider the financial implications of meeting them. These depend both on the cost per unit, whatever the unit is - a school, a classroom or a pupil - and on the number of units needed in the national expansion programme. Thus the second major topic is Costs. To know what size of cheque to draw, or even to have the necessary finance available, will not alone ensure that money is converted into the right kind of buildings at the right time and in the right locations. So the third major topic covers the problems of Implementation.

35. The rest of this report is an attempt to evaluate the project in terms of these three main topics, Standards, Costs and Implementation. In doing so it describes the major working methods employed

by the national teams and the difficulties which were encountered. The major results and recommendations are described and attention drawn to limitations on their validity. Quantifiable results are shown in annotated tables (see statistical annex) which are collated except in cases where dissimilarity in types or level of institution studied render comparison nugatory. Finally attention is drawn to the wide range of possibilities still unexplored which constitute a vast field for continuing research and investigation.

CHAPTER II : STANDARDS OF QUALITY

The Basic Conflict

36. All DEEB countries feel acutely the need to keep school building costs as low as possible. Yet the most vigorous measures for cost reduction will be futile unless pupils and their teachers have enough space to work in, and unless that space is properly lighted, warmed, ventilated, furnished and equipped. Thus the question of what standard of quality can be accepted in the light of a country's educational and economic situation lies at the root of any investigation into school building requirements. Only when the appropriate level or standard of quality has been determined is it possible to see where extravagance has occurred in the past or where savings may usefully be sought in the future; only then is it possible to estimate how much new school building is needed to relieve overcrowding, or how much money is needed to bring existing substandard schools up to the required level.

37. To determine the acceptable level of quality is, however, by no means easy. The minimum acceptable standard of school building, like the minimum acceptable standard of living, tends to rise with income. No DEEB country yet feels able to afford sound-absorbent finishes on ceilings, walls or floors. Yet instances have been observed where total lack of sound absorption prevents even the most attentive listener from catching the teacher's words. Since no-one has realised what the difficulty is or how it may be remedied, sound absorption is considered a luxurious frill. This appears less serious than it is because most teachers in DEEB countries expect their classes to sit quiet and listen to what they are being told. But without adequate sound deadening even the most adventurous among them will hesitate to introduce the rather noisier methods of active class participation which teachers in richer countries are now finding so effective. How far, therefore, should quality rise above the average level of demand, remenbering on the one hand that resources are so limited, and on the other that enrichment of resources depends so largely on enriching education ?

38. Then there is the question of how far school standards should rise above, say, those of housing. Is the total absence of heating in certain Portuguese and Spanish schools justified by the fact that even though, in winter, the writing hands of pupils get too numb to hold a pencil, winters last only six weeks or so and local people take

pride in being hardy ? Three Turkish primary school children have to sit at desks which many people would think inadequate for two, but does it follow that the standard should be raised when many Turkish children live in villages lying more than a day's journey away from any school at all ? These are only random examples of the dilemma imposed on DEEB teams by the slenderness of their national resources. They illustrate the basic conflict between the desirable and the practical.

Disparities

39. Where standards of quality should be pitched is thus a matter for judgement rather than precision. And it is not surprising that teams have found wide disparity in the provision made, the only exception being schools built to a standard (in the sense of repetitive) plan and specification, a practice which has disadvantages on other grounds and is not recommended for general application. Disparities are found in the level of functional performance, in the provision of furniture, fittings and equipment, and in the amount of floor area provided.

Functional Performance

40. Disparities in functional performance sometimes arise where departures have been made from traditional practice, often with good reason, but without full recognition of all that the departures imply. This is particularly noticeable where prefabricated buildings provide a much inferior protection against solar heat gain compared with traditional construction having a high thermal capacity. In the case of natural and artificial lighting, an unexpressed consensus on what is acceptable reflects an imperfect understanding of lighting criteria and technology and results, in fact, in disparities which have gone unnoticed. With heating, provision varies considerably, due largely to the many instances where too much money has already been spent on the building before the heating installation (for which there is usually a separate contract) comes to be considered. All countries need to pursue questions of functional performance further than they have done so far, and this will be increasingly important as new forms of construction are introduced.

Fittings, Furniture and Equipment

41. Similar considerations apply to the provision of fittings, furniture and equipment inside the completed building. A census conducted in 1962 by the Greek Organisation for School Building revealed striking disparities in the level of equipment provision, as Table 12, drawn from the Greek report, indicates. The Greek team expresses the view that :

> "The question of equipping primary and secondary schools in Greece with modern furniture, teaching aids and equipment has been dealt with in the past as a separate problem and not, as it should have been, as an integral part of the provision of school building. It is worth noting in this respect that the estimates for school buildings so far prepared do not include the cost of equipping the buildings with furniture, teaching aids, etc., with the result that school buildings are completed and delivered without even the most essential items of furniture.... Apart from some furniture there is no standardised equipment for different types of schools; the design and standardisation of school equipment and research into its problems have not been sufficiently developed."

As an indication of how the situation might be remedied the team has drawn up a list of all teaching aids considered necessary for three sizes of primary school and for one size of secondary school, and have estimated the cost of providing them. Unexplained inconsistencies in some of the Greek cost calculations suggest that the figures should be re-examined and that no firm conclusions should yet be drawn from them; but subject to this reservation the figures indicate that furniture and equipment together amount on average to 23% of the building cost in primary schools and 28% in secondary.

42. The Portuguese team has recognised the importance of furniture as an indispensable part of school provision to the extent of producing a new range for their école témoin at Mem Martins, near Lisbon. The experience of all teams underlines the importance of considering furniture, fittings, equipment and building together rather than separately, and emphasises the need for careful co-ordination if responsibility for their provision rests on more than a single organisation. The case of Yugoslavia, where disparities in provision reflect differences in policy and practice by numerous autonomous school building

authorities, emphasises the need to have uniformly agreed standards if all pupils are to enjoy equal educational opportunity.

43. Exceptional but significant cases have been observed where expensive laboratory fittings were installed but could not be used because money for the necessary service connections had been spent on other items and additional money could not be obtained for several years after the building had been "completed". Waste of a similar kind has been observed in schools which have been based on foreign models admired by the architect concerned but designed in terms of wholly different educational requirements. Thus there is a need, not only for minimum requirements to be clearly stated, but for them to be based entirely on the educational requirements of the country concerned. Study of another country's standards will be illuminating only if accompanied by thorough understanding of their educational basis, and the wholesale transfer of standards from one country to another is to be treated with the utmost caution.

Minimum and Maximum Standards

44. Standards of floor area, with the fittings and equipment so closely associated with them, are the most important in both their educational and financial effect. Here a distinction is needed between the gross floor area of school and the educational activity area which it contains. It is the latter which must conform to a minimum if educational standards are to be satisfactorily met; and the more the gross floor area exceeds it the more is there likely to be extravagant provision of corridors, staircases, sanitary accomodation, plant rooms, etc., serving ancillary purposes only.

45. All teams have analysed a number of schools of different level and type in terms of gross area and educational areas, a typical analysis being shown as Fig. 1.

46. Some teams have discovered the curious paradox that disparities in gross area were much greater than those in educational area (Table 1). Examination has shown this paradox to be a reflection of administrative restraints imposed in an attempt to keep down costs by stipulating a maximum which the area of teaching rooms was not permitted to exceed. But such restraints had ignored the need to control the quantity of other accommodation. Consequently procedures intended to prevent extravagance had produced the opposite effect: expenditure on

Fig. 1

" OBSERVATION CYCLE " SCHOOLS

71	Name of the school
72	Type of the school
73	Nᵉʳ of teaching spaces
74	Nᵉʳ of places
75	Nᵉʳ of pupils
76	Nᵉʳ of equivalent pupils

SHEET 17.1

AREA ANALYSIS

	Proposed standards m2/pupil	TEACHING AREA		Nᵉʳ of spaces	Area m²	Nᵉʳ of places	Area Place
	1	2	3	4	5	6	7
1		GENERAL CLASSROOMS					
2		SPECIAL CLASSROOMS	Living languages room				
3			Mathematics room				
4			Science and geography room				
5			Drawing-room				
6			Girls' arts and crafts				
7			Handicraft				
8			Smithy				
9			Music room				
10							
11							
12							
13							
14							
15			TOTAL				
16		GYMNASIA	Boys				
17			Girls				
18			TOTAL				
19		LIBRARY					
20		WORK AREAS	Boys				
21			Girls				
22			TOTAL				
23		TEACHING AREA TOTAL					
24		SITE AREA	Built				
25			Playgrounds				
26			Gymnastics fields				
27			Playing fields				
28			Kitchen garden				
29			Fenced area				

RATIOS

30	Teaching area/ Floor area	
31	Ancillary area/Teaching area	
32	Circulation area/ Floor area	
33	Circulation area/ Teaching area	
34	Built area/ Site area	

	Proposed standards m2/pupil	ANCILLARY AREA			Nᵉʳ of spaces	Area m²	Nᵉʳ of places	Area Place
	8	9	10	11	12	13	14	15
35		MULTIPURPOSE ROOM						
36		STORAGE	TEACHING	Science and geography ann.				
37				Drawing annexes				
38				Handicraft annexes				
39				Gymnasium annexes				
40				General				
41				TOTAL				
42			GENERAL					
43			TOTAL					
44		ADMINISTRATION STAFF		Secretary				
45				Headmaster				
46				Teaching staff				
47				Medical installations				
48				Maintenance staff				
49				TOTAL				
50		SANITARY ACCOMODATION		Boys				
51				Girls				
52				TOTAL				
53				Staff				
54				TOTAL				
55		CLOAK-ROOMS		General				
56				Gymnasium				
57				TOTAL				
58		DINING ACCOMODATION		Dining-room				
59				Kitchen and annexes				
60				TOTAL				
61		CIRCULATION	INTERNAL	Corridors				
62				Staircases				
63				Entrance halls				
64				TOTAL				
65			COVERED AREAS	Covered playgrounds				
66				Covered ways				
67				TOTAL				
68			TOTAL					
69		ANCILLARY AREA TOTAL						
70		FLOOR AREA TOTAL						

	16	17		18	19	20
	UNIT VALUES					OBSERVATIONS
77	AREA PER PUPIL	Site				
78		Playground				
79		Floor				
80		Teaching				
81		Multipurpose room				
82	AREA PER EQUIVALENT PUPIL	Site				
83		Playground				
84		Floor				
85		Teaching				
86		Multipurpose room				
	QUANTITY FACTORS					
87	NUMBER OF STOREYS	Classroom building I				
88		Classroom building II				
89		Multipurpose building				
90		Gymnasium building				
91	FLOOR-FLOOR (HEIGHT)	Classroom building I				
92		Classroom building II				
93		Multipurpose building				
94		Gymnasium building				
95	SANITARY FITTINGS	BOYS	W.C. and vidoirs			
96			Urinals			
97			Washing basins			
98		GIRLS	W.C. bidets & vidoirs			
99			Washing basins			
100		TOTAL				
101	RATIOS %	Window area/floor area				
102		Ext. solid walls/floor area				

gross area remained unlimited, yet however high it rose no increase was allowed in the real educational facilities it purchased.

47. Where teams have found such procedures in operation they have recommended that they be changed. Instead of putting an upper limit to the area of any teaching room, they point out that true economy demands that a minimum floor area be stipulated, below which teaching rooms can not be regarded as satisfactory for their purpose. Unless the money expended is enough to meet this minimum need, they argue, there is no useful purpose served in spending it. In some cases the new minima are above the old maxima, but where this is so the team concerned has been able to show that the increase can be paid for by economies to be found elsewhere, either by reductions in cost per square metre (as will be seen in the following chapters) or, more usually, by reducing the amount of gross floor area, or by increasing the number of hours per day during which each room is used and thus reducing the number of such rooms required.

Raising Standards

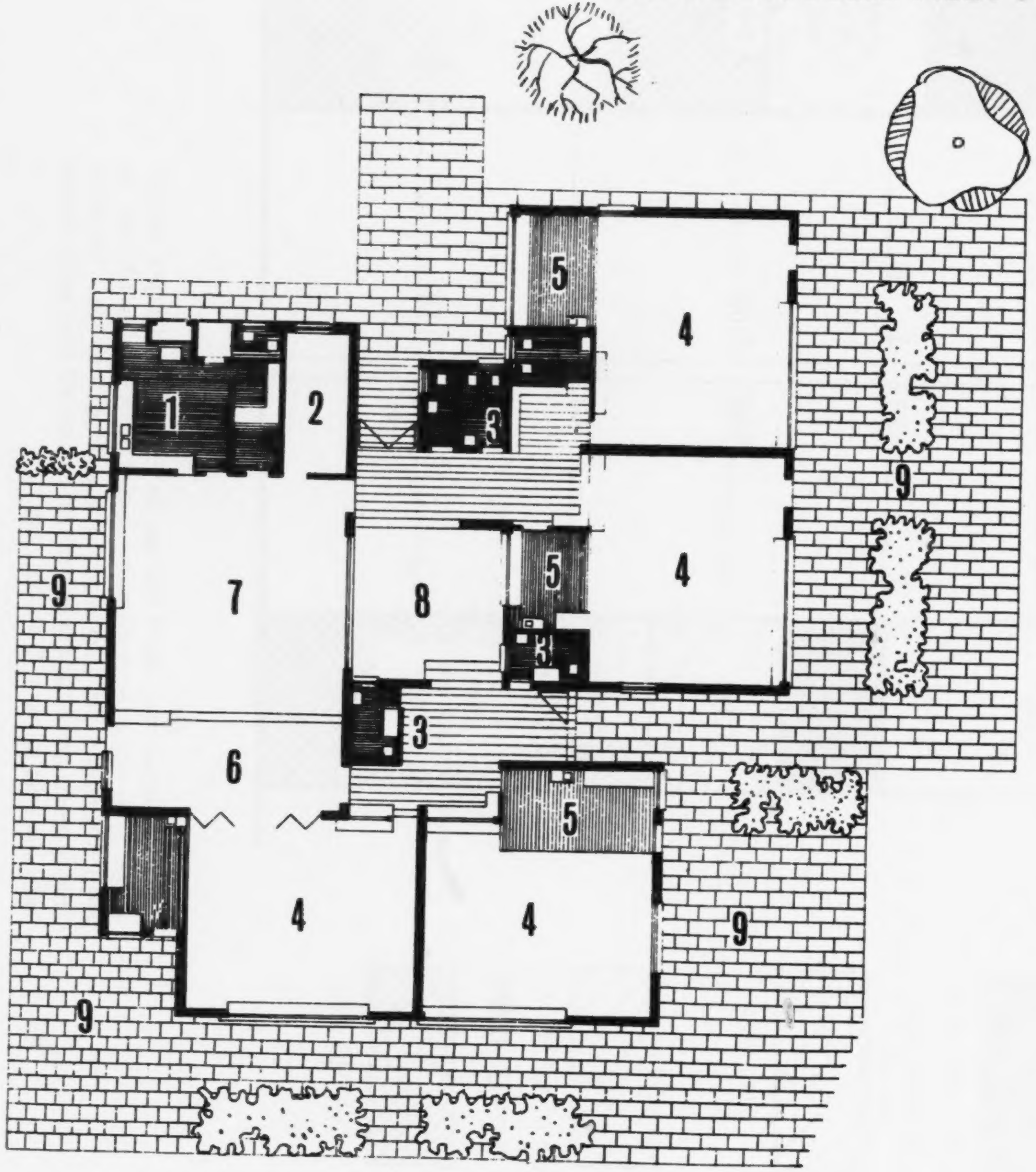
48. The most striking example of how standards may be raised by making economies elsewhere is the primary school built as an école témoin to the plans and specifications of Portuguese team. A plan of this school is shown as Fig. 2. Diagram A. compares the area provisions of this school with those of one of its immediate predecessors, and shows how skilful planning has produced an increase in teaching area of some 25% with no corresponding increase in the gross area of the school.

The Educational Basis of Standards

49. All teams state, explicitly or implicitly, that they have based their recommendations as to the minimum area of teaching spaces (Table 2) on a study of the educational activities that go on in them. Thus the shape and size of the classrooms in the primary school just referred to stem from the observation that teachers were now seeking ways of introducing into such schools a wider range of activity than is possible where children sit in rows of desks facing the blackboard. More working surfaces were found to be required, as was the need for extensive flat surfaces of the kind which could only be obtained by placing several tables together. In addition to this, provision was needed for practical activities in which children could make models

FIGURE 2

THE PORTUGUESE PILOT PROJECT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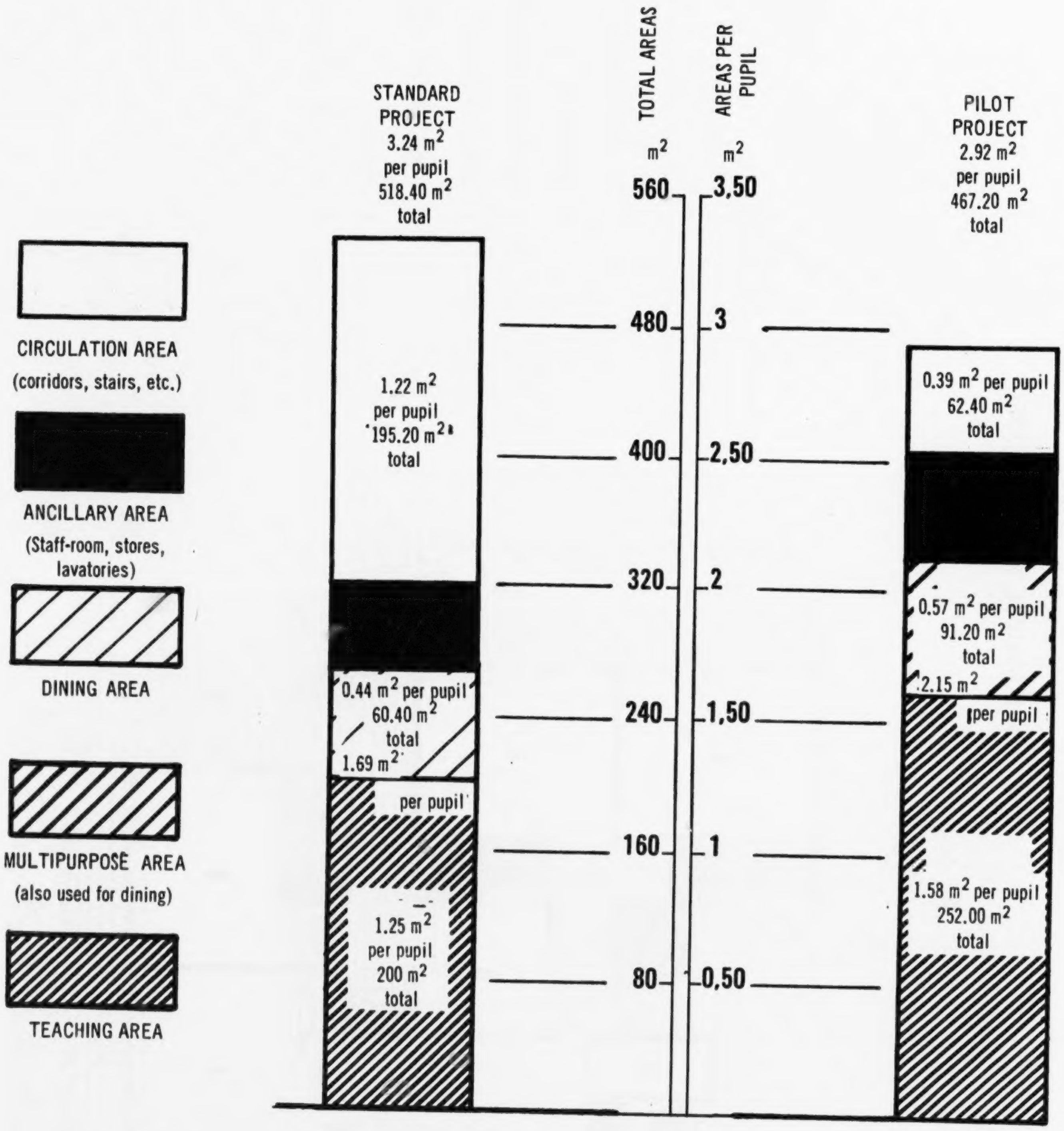
1. KITCHEN
2. TEACHER'S ROOM
3. CLOAKROOMS AND TOILETS
4. CLASSROOM
5. PRACTICAL WORK BAY WITH SINK
6. SMALL LIBRARY
7. MULTIPURPOSE HALL
8. PATIO
9. OUTDOOR PAVED PLAY AREAS

DIAGRAM A

THE PORTUGUESE PILOT PROJECT

AREA COMPARISON



The above diagram shows how in total area the Portuguese pilot project (on right) is only 82 per cent as big as the current standard 4-class school (on left). Yet the effective teaching and multipurpose area is increased by 27 per cent. This overall economy results from eliminating non-essential corridors and stairs and so reducing circulation areas by nearly 70 per cent.

connected with their studies, conduct simple experiments, cultivate indoor plants, etc. Thus it became necessary to increase the classroom area over what had previously been considered adequate, to incorporate in it space for practical activities and to provide it with a sink and running water.

50. The Yugoslav team also has recognised the need for classrooms to be capable of more flexible arrangements and include diagrams in their report to show how alternative furniture lay-outs may be accommodated in their general classrooms. The Greek team have done the same, (See Fig.3), but they have gone further than any other team in explaining the reasons for their proposals:-

> "The accepted maximum number of pupils per classroom is 40. It is taken into account that the general classroom in the primary school fulfils a variety of functions, since a great number of varied activities takes place in it every day. Therefore the exact use of the classroom cannot be prescribed in detail. Separate consideration is given to the classroom of primary schools of 40, 80, 120 pupils and that of regular school of 240 pupils, since the classrooms in the smaller schools must fulfil more functions and must therefore be differently equipped.
>
> General Classroom
>
> /¯For schools of 40 - 120 pupils._7
>
> The method of teaching in each classroom is based on group and individual work with the pupils sometimes discussing matters among themselves and not directly with the teacher. Therefore desks must be arranged in groups, not in a series facing the chalkboard. The teacher may wish to sit beside some pupils to help and guide them in their work; moreover, when the teacher is occupied with a group of pupils, possibly from one or two grades, the pupils in other grades continue their group or individual work quietly so that the first group can concentrate on what the teacher is telling them. The classroom must therefore be of such a size and shape as to facilitate varying arrangements of furniture, which are also necessary because of the different requirements of each subject, hence the replacement of the conventional desk by a table and chair. In order to facilitate the juxtaposition of tables, table-top dimensions should have a ratio of 1/2; in this way, for

example, two tables put together give a square table for 4 pupils. Recommended dimensions for a 2-seat table for a primary class are 55 cm. width and 2 x 55 = 110 cm. length, i.e. 55/110. Two seat tables facilitate the conventional arrangement of desks facing the teacher, while square and round 4-seat tables facilitate group arrangement.

Although a diagonal arrangement of square tables is uneconomical in terms of usage it ensures sufficient light for all pupils. Two-seat tables can be combined for 8 to 10 pupils in"star" or circular patterns. Single-seat tables lead to uneconomical arrangements. The other furniture and equipment taken into account in designing this classroom were the following:

(a) cupboards, shelves and show-cases for apparatus and materials for physics and chemistry;
(b) cabinets or files for storing materials and work done by pupils;
(c) display boards of soft material mounted on the wall for pinning up maps and pupil's work;
(d) chalk-boards;
(e) classroom bookcases;
(f) cupboards for tools and instruments used by pupils in sewing, carpentry, drawing and other artistic activities;
(g) bench for arts and crafts;
(h) wash-basin;
(i) teacher's desk.

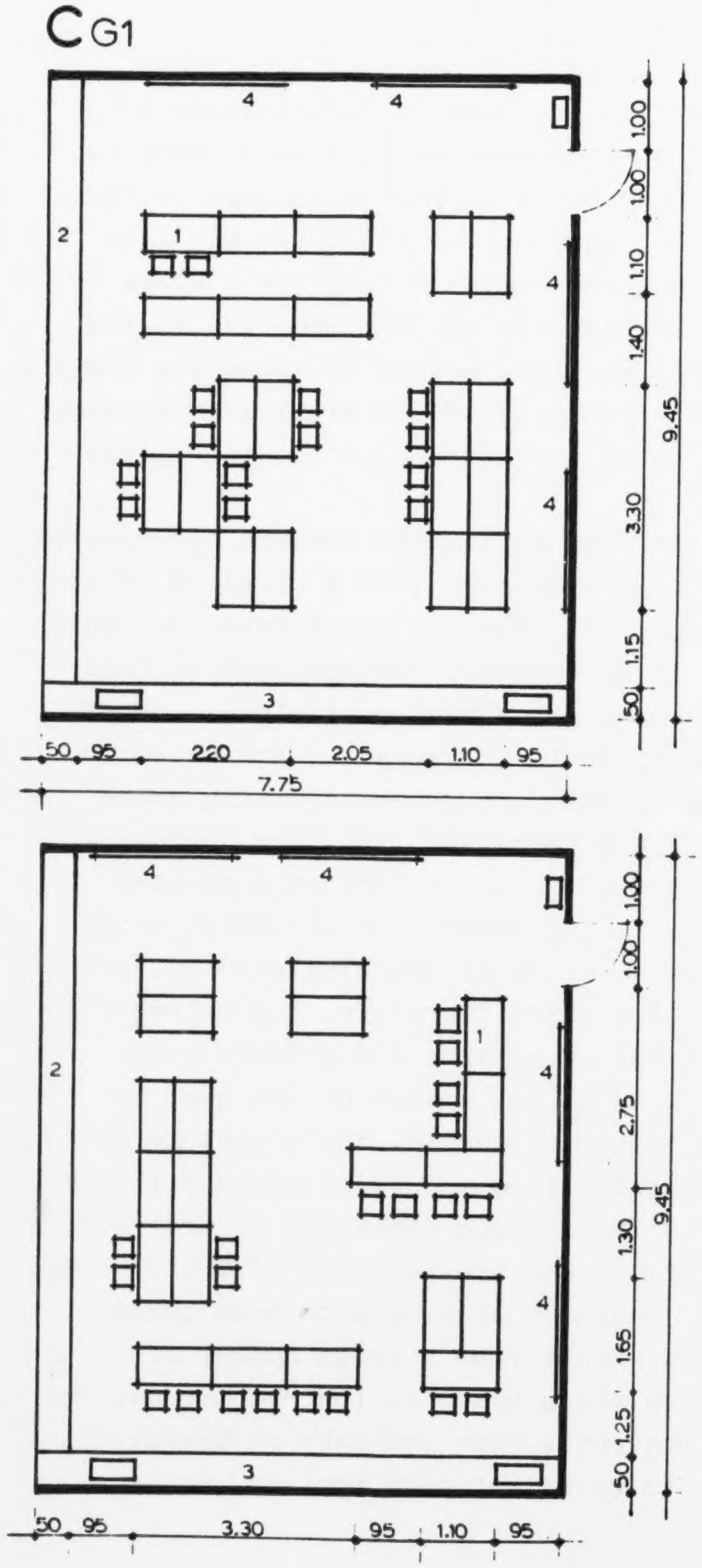
Three possible layouts were considered on the basis of the above; for the layout finally chosen the total area required amounts to 73.23 or 74 sq.m., i.e. 1.85 sq.m. per pupil."

51. The Greek proposals for science accommodation are less convincing. They postulate a science room even in primary schools, but visualise it as serving 40 pupils at a time, of whom 20 will be occupied on experimental work while the remainder watch a demonstration in the other half of the room. Such a proposal has all the marks of a theoretical idea whose educational implications have not been fully considered or tried in practice. It suggests that Greek educationists and architects need to make a joint study of science teaching in countries which have more experience of it. (Significant here is the statement in the Greek report that, in addition to general inspectors of schools there is

FIGURE 3

GENERAL CLASSROOM IN PRIMARY SCHOOLS

P 40, P 80, P 120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1
2
3
4
1.00
1.00
1.10
1.40
3.30
1.15
50
9.45
50
95
220
2.05
1.10
95
7.75
2.75
1.30
1.65
1.25
3.30
95

Floor area : 73.23 - 74.00 SQ.M.
Area per pupil : 1.85 SQ.M.

Legend :

1. 2-place tables
2. Cupboard
3. Bench
4. Chalkboard or pin-up boards

"one inspector for foreign and minority schools, one for Greek schools abroad, one for the English language, one for French, one for the arts, one for music, one for home economics and five for physical education" - but none, apparently, for science!)

52. The Portuguese proposals in respect of science are similarly questionable. For example, in one type of school the Portuguese stipulate a science laboratory with a minimum area of 57.2 sq.m. This is only 2.8 sq.m. more than is specified for a general classroom in this type of school, and it is difficult, in fact, to visualise any kind of laboratory suitable for practical experiment which, for a class of 32 pupils, is less than 63 sq.m. Perhaps the explanation lies in the fact that what is in mind is simply an amphitheatre in which the teacher demonstrates but where the pupils conduct no practical experimentation for themselves. If this is so it is an interesting reflection on the underlying educational attitudes.

53. Some curious discrepancies are also noticeable between one country and another. The recommendation for a gymnasium (for a class of 30 to 40 pupils) is 200 sq.m. in Portugal, 288 sq.m. in Yugoslavia, but only 80 sq.m. in Spain. In the latter case, however, the explanation lies in the Spanish team's general recommendation that multiple use should be made of large spaces in a school, so that gymnastics are expected to overflow the 80 sq.m. allotted to them and share adjoining space allocated, as far as the standards are concerned, to other purposes. The Greek proposals for physical education space reflect a similar approach: "The use of indoor space is not imperative in Greece owing to the mild climatic conditions which allow of teaching physical education outdoors almost throughout the year. Therefore, the relevant designs provide only a shelter of 180 sq.m. area (10 x 18 m.), to protect the pupils from rain and wind during spells of bad weather. However, in schools with a large number of pupils, there will be an indoor space, which will function chiefly as a multi-purpose hall".

54. The Turkish team did not question current standards of area and to do so will be an urgent priority in any continuation of their work. The Spanish report gives minimum areas for each type of room under consideration and states that they result from a large number of analyses and trial and error sketch plans based on the recommendations of educationists, but omits the reasoning "for the sake of brevity". If the recommended standards are to be effectively applied, it is

essential that there should be no doubt about the educational reasoning behind them. It is therefore to be hoped that the national reports will be followed by a further publication which will fully explain the basis of the recommended standards. Such a publication would of course carry greater weight if the standards in question had been put to practical test in an "école témoin" or "development project". Those Portuguese recommendations which have been put into effect in the development project at Mem Martins certainly carry more conviction than the others.

The Number of rooms required

55. The total minimum floor area required for the educational activity of a school is, of course, not solely dependent on the minimum needed for each individual teaching space, but also on how many such spaces are needed to serve the number of pupils whom the school is planned to accommodate. Here many teams ran into the immediate difficulty that school capacity was commonly reckoned in terms of classes rather than of pupils. When, in examining an existing school, they asked how many pupils it had been planned to accommodate, they would be told that this was not known: it was designated a six-class school, but how many pupils there were depended on how many pupils there were in each class; and there was no official standard for the number of pupils a six class school was intended or expected or assumed or planned to hold. This seemed in curious contradiction to the existence, in virtually every case, of an official maximum for the approved number of pupils in a class. Clearly, unless the expected number of pupils is known, no rational provision can be planned for the amount of cloakroom space or sanitary accommodation or for any other item which is proportional in size to the numbers it serves. The teams therefore dismissed the apparent anomaly as simply reflecting the fact that force of circumstance so often cause official maxima to be exceeded, and assumed that the total number of pupils would be the number of classes multiplied by whatever official maximum applied.

56. Proceeding on this assumption the teams then turned to examining how many rooms of each type and size were required in a school of an assumed capacity. In most primary education the answer seemed easy and obvious, the traditional answer being that the number of class spaces needed was equal to the number of classes and no more, although in Portugal there was some demand for an extra space suitable for gym-

nastics or dancing or as a place where two or more classes could combine. Beyond the primary level, however, traditional answers appeared extravagant. Not only was there a separate room for every class, but special rooms as well - laboratories, craft rooms, gymnasia, etc. Larger and more expensively equipped than ordinary class rooms, such rooms were nevertheless unoccupied for much of the school day, and even when one was in use the effect was to empty a class room. Was there not, perhaps some way of avoiding this wasteful under-utilisation?

Curriculum Load Methodology

57. To assist the teams in answering this question OECD consultants developed in the course of the project a basic methodology for calculating the minimum number of rooms required for a fixed number of classes to follow a stated curriculum. The methodology relates the capacity of teaching spaces to the load imposed on them. It treats the capacity of a teaching space as a function of its size and of the total number of hours per week (assuming that a week is the curriculum cycle) during which classes are simultaneously present in the school; so that a space large enough to contain a whole class has a capacity over a 30 hour period of 30 class-hours, one of half the size having a capacity of 15 class-hours and so on. The load on such a space is the total number of class-hours devoted to the subject which is taught in it during the same period of simultaneous attendance. Seven classes studying science for six hours each out of thirty that they are all simultaneously in the school would impose a load of 42 class-hours on the science accommodation. Thus three half-class laboratories would be needed (with a combined capacity of 45 class-hours) or, if half-class teaching were impracticable, two full-class laboratories with a combined capacity of 60 hours and a consequent under-utilisation of 18 hours.

58. The application of the methodology is best seen in relation to the second of the Portuguese écoles témoins, at present in project only. This is for a new type of two-grade school forming a bridge between primary and secondary education. The same subjects are studied in each grade and the same amount of time devoted to them. There are 11 classes in each grade, making 22 classes in all. Table 3 (a) shows the number of hours devoted by each class to each subject in the

curriculum and the consequent load imposed by all classes. The total hours in the curriculum total 28. If no class remains at school longer than this curriculum requires, and if all classes start and end the day at the same time, the capacity of each full-class teaching space will be 28 class-hours. But a capacity of only 28 does not divide easily into the loads imposed, so that while 2 science laboratories, for example, would have a capacity which is 10 class-hours too small for the load, 3 laboratories provide a capacity of 18 more than are needed. The effect over the accommodation as a whole is to provide 26 teaching spaces for only 22 classes - not a very economical result. If, however, the pupils can be kept at school for an extra 5 hours per week, so that the period of simultaneous attendance is raised to 33 hours, one less special (and comparatively) expensive room is needed for Modern languages, for science, for mathematics and for drawing. On the other hand, the net gain is smaller than this might suggest, since some extra space is needed to accommodate pupils in the extra-curricular hours that have been added. As table 3(b) shows, the result of increasing the period of simultaneous attendance is a 16¼ % reduction of the educational activity area required, from 95.2 to 79.7 sq.m. per class. Although this space is shown in Table 3 (b) as two general class rooms, it does not need to be in this form and the Portuguese team have in fact suggested that the extra space would be better provided as a school library in which pupils may study under only one supervisor.

59. The Spanish team rightly warn against pressing this technique to the limit, drawing attention first to the fact that every pupil in the school may need some kind of base, and secondly to the dangers of imposing undesirable restrictions on future changes in curricula. They have also found it necessary to elaborate the techniques outlined above in order to make provision for subjects which at a certain level are taught to classes of reduced size. Such elaboration is, in fact, only one device among many that are needed if all educational possibilities are catered for. In practice, all students in a school are most unlikely to follow an identical curriculum. Where a wide range of curriculum choice is offered it may well be impossible to say how many students will opt for a specific choice from year to year. The trend towards this wider choice is accompanied by new instructional techniques resulting from advancing knowledge of educational psychology,

and by recognition that machines can be used to release the teacher from mechanical tasks and free him to concentrate more intensively on those where individual and personal contact with the student are indispensable. At the same time the pupil is rapidly assuming a more active rôle in his own education in which practical experiment and manual work grow in importance alongside more conventional school activities. All such factors mean that the 30 or 40-pupil class which has hitherto formed the basis of most primary and secondary school organisation, is already giving way to a much wider range of groupings. Thus, the determination of space requirements by the curriculum load method is likely to need considerable further elaboration. The principle, however, remains valid. Difficulties which arise represent what is in effect a challenge to the joint ingenuity of educationist and architect, and if that challenge is met with an imaginative response, the difficulties can be overcome.

60. In applying the principles, teams have also made provision for various kinds of rooms such as libraries or dining rooms which, while not serving a strictly curricular purpose, are nevertheless regarded by the country concerned as essential to the educational purposes of the school. As was to be expected they found that the resulting area per pupil differed according to the number of pupils for whom the school was planned. Table 4 shows for each country the recommended minimum area per pupil and how it varies according to the capacity of school and type or level of education.

61. A natural corollary to stipulating a minimum area for educational activity is a minimum area for the land on which the building is sited. In determining the latter the teams had regard to the ground area needed not only for the school building itself but also for such out-of-door educational activities as games, horticultural studies, etc. (Table 5).

Standards and Policy

62. Besides demonstrating the curriculum load effect, the work of the Portuguese team also brings into sharp relief the fact that standards can not be separated from educational policy. This is not to say that teams were ever expected to shape educational policy. Nevertheless, when policy is seen in the light of its school building consequences there may well be strong grounds for reconsidering or even modifying it.

63. The school at Mafra on which Table 3 is based is for two grades of pupils only, in the 10-14 age range, and is intended to provide a type of course new to the Portuguese educational system, an "observation cycle" introduced in conjunction with raising the school-leaving age. After completing the course, pupils will either leave school altogether or go on voluntarily to grammar or vocational courses. At the time the project came under consideration three alternatives were open to policymakers: to provide for the new course either in primary schools (thus giving it too much of an elementary character) or in secondary schools (thus raising the dilemma of whether vocational or grammar schools should be chosen for the purpose) or in entirely separate institutions as in the case of Mafra. Choice of the third alternative means that to support a school the size of the one at Mafra, which has over 700 pupils, a very large recruitment population is needed. This may be no objection in densely populated areas, but in rural localities the necessary recruitment population may be dispersed over such a wide area as to cause great difficulties in getting pupils to school. It is desirable therefore to consider the effect on school building of recruitment areas incapable of supporting large schools.

64. Table 3(c) shows that, provided arrangements can be made to increase the period of simultaneous attendance to 36 hours per week a school of only 12 classes need be hardly less economical in area than one of 22. By the same token, a school of 10 classes with 30 hours per week would need one space for each of the specialised subjects and 4 general classrooms, giving a total educational area of 82.46 sq.m. per class. With only 8 classes, as will be seen from Table 3 (d) no device for increasing teaching space capacity can be found, so that the area per class rises sharply to 96.13 sq.m. By teaching 12 hours of music in the gymnasium and the remaining 4 in the general classrooms, the music room could be dispensed with, effecting a reduction in total educational area of 57.2 sq.m., bringing the area per class down to 89.0 sq.m. But this is the maximum reduction possible, and would be made at the expense, presumably, of satisfactory music teaching. Thus, insofar as the Portuguese example is concerned, the provision of two grade schools of less than 12 classes will mean a sharp increase in cost, which can only be slightly offset by a reduction in standards.

65. There is the strongest possibility (although the Portuguese team have not yet examined it) that the difficulty could be overcome if the observation cycle were attached to, and shared the accommodation of, a school catering for a higher age group. Clearly then, this is a consideration to be taken into account in deciding the institutional form of the new cycle, and although it is not suggested that such a consideration will over-ride all others, the Portuguese authorities are strongly recommended to examine it.

66. The Yugoslav team have also examined the curriculum load effect in relation to schools providing general co-education for the 7 to 14 age group, with chemistry, physics, biology, craft work and domestic science as part of the curriculum. Here there is no possibility of attaching such a school to one for a higher age group and no satisfactory way of avoiding the diseconomies inherent in small schools. Thus, the question arises, as it is bound to do in all countries: are the demands of economy so insistent that small schools must have lower standards than the rest?

67. The Yugoslav team have answered this question somewhat equivocally. On the one hand they say, in effect, that no matter how small the school it must have one special room for foreign languages and another for domestic science, and furthermore that these rooms should be 20 and 28 sq.m. respectively, whether they serve 864 pupils or only 216. On the other hand they say that if the school has no more than 4 upper classes (144 pupils) the workshop and laboratory should be coalesced into a single dual purpose space, and the school is too small to warrant a gymnasium.

68. The Portuguese team identified a need in primary schools for a multi-purpose (polyvalente) space, larger than even the enlarged ordinary classrooms and additional to them; and it will be seen that such a feature figures in their école témoin at Mem Martins. But in their recommended standards they omit such provision from their smallest schools, prompted presumably by the belief that to do otherwise would result in a grossly disproportionate area per pupil. The omission is, however, much to be questioned. It tips the scales so far the other way that the smallest schools then have a lower floor area per pupil than those with the polyvalente - so that, on the face of it, the most economical way of providing schools for primary education in Portugal would be to ensure that none was large enough to merit

a polyvalente. This reductio ad absurdum could be avoided if the ordinary classroom areas in the smallest schools were increased to a point where the total area per pupil was at least equal to that in schools containing a polyvalente, even if the increase were not quite sufficient to compensate more than partly for its omission.

69. A similar inconsistency is found in the Greek proposals where special accommodation is only provided in schools for more than 120 pupils. This means that the area per pupil, which is 3.37 sq.m. in a 120 pupil school, leaps up to 3.93 sq.m. - an increase of 18% - in a 240 pupil school. The plain fact is that the smaller school is merely enjoying inferior facilities.

70. The Spanish recommendations squarely face the reality that to provide schools of equivalent standards the area per pupil can not be constant for all capacities, but will tend to be higher for smaller schools. Given uniformity of standards this is bound to be true for all countries.

Unexplored Possibilities

71. In Yugoslavia all schools have to work in shifts, and it is only recently that a minority have ceased to work four shifts a day. The possibility that shift-working might be entirely eliminated lies at the moment beyond any practical hopes, and the present aim is simply "to eliminate the third shift". Except for advancing it as an argument for the utmost economy, the Yugoslav report does not examine the shift system and its implications. This would be a serious criticism of the Yugoslav team were it not for the fact that the extreme decentralisation of educational administration, which is cardinal in Yugoslav policy, makes a proper appraisal of how the shift system is operated in different republics and communes a study in itself.

72. OECD consultants visiting Yugoslavia have noticed, however, that in some schools a number of second shift classes are already in school before all the first shift have left, so that shifts in schools do not seem to be wholly analagous to those in factories. This has prompted exploration of a methodology for reducing the amount of educational space required by resort to a modified shift system which, while extending the hours per day in which the school is used, avoids the necessity either for reducing the number of hours devoted to the curriculum or for bringing one shift to school at a very late hour of the day.

Overlapping Shift Methodology

73. This methodology is based on dividing the total number of classes attending the school as near as possible into three shifts, but arranging for each shift to overlap the other. At this point we should say that although we have hitherto spoken, for simplicity's sake, in terms of curriculum "hours", the periods in which curricula are timetabled are normally 40 to 50 minutes long with short breaks between them. Thus an 8 class school working a thirty hours curriculum per five day week would occupy the school according to the pattern shown in Fig. 4. By applying the overlapping shift methodology to the 8-class Portuguese school referred to above, it becomes possible to make very substantial economies, reducing the total educational activity area from 769.0 sq.m. to 530.4 sq.m. - a reduction of 31% to 66.4 sq.m. per class. Applied to the 12-class example of Table 3(c) the area is reduced from 933.20 sq.m. to 770.00 sq.m. (17½ %), i.e. to 64.40 sq.m. per class.

74. From this it will be seen that an overlapping shift system would appear to have a number of important advantages. Beside the very considerable economies which can result, inequalities of area per class or per pupil between schools of different capacity can be more easily minimised - as the Portuguese example shows. But there are subtler advantages still which may not at first sight be so evident.

75. All countries participating in the project are experiencing, to a greater or lesser extent, the difficulties caused by the process of industrialisation and consequent gradual migration from rural to urban areas. By judicious application of the overlapping shift device some of these difficulties could be eased. In rural areas a phased programme could begin by operating an unmodified shift system, and then go on to an overlapping shift system and finally to a non-shift system as the population declined. Urban schools, on the other hand, might be planned initially on a non-shift basis, but with a balance of accommodation designed to enable them to accept a considerably increased intake by the adoption of overlapping shifts. Provided that existing schools contained accommodation of the type and quantity appropriate to the curriculum load imposed, they too, could accommodate over-lapping shifts. And where pressure on urban accommodation is already severe the most effective early remedy would almost certainly be to provide existing schools with the adaptations or additions needed. (It is

unlikely that existing schools could be used to full advantage in this respect without modification or addition of some king).

76. Reverting momentarily to the case of Yugoslavia, a thorough analysis of the possibilities and implications of the overlapping shift methodology under Yugoslav conditions might well point the way to speedier eradication of "the third shift". The outcome of such an analysis can naturally not be predicted with any certainty, but new ways of arranging school time-tables and new ways of using existing accommodation might suggest themselves, which would result in a larger number of pupils being able to use the present quantity of accommodation over a shorter working day.

Dual Use of Accommodation

77. Both the curriculum load and the overlapping shift methodologies are in essence directed towards intensifying the use to which each sq.m. of accommodation is subjected in the course of a school day. Intimately linked with this object is the concept of dual use of accommodation, i.e. using the same room for more than one specialised activity, so avoiding the under-utilisation which would result from its being reserved to a single activity only. The economies effected by overlapping shifts rest basically on the fact that, for example, in the 8 class school not more than 5 classes occupy the educational activity areas at any one time; but to take advantage of this the number of class spaces provided must be as near to five as possible. For the curriculum in the example, six spaces are needed - compared with the 10 needed without shift overlap. This clearly rules out the possibility of having the seven specialised spaces shown in Table 3(d); and the potential economies are made, in the example, by teaching mathematics in the science laboratory, music in the gymnasium and drawing in the craft workshop.

78. Undeniably, devices of this kind are liable to lower standards, but surely not inevitably. Is there not, in fact, a close affinity between the subjects as paired, both conceptually and in the kind of apparatus, equipment and space they need?

79. The Yugoslav team has recognised the need for dual use by specifying a general purpose laboratory for their smaller schools instead of separate laboratories for chemistry, physics and biology. The Spanish report, also, shows how the salon de actos, or assembly hall,

Fig. 4.

Example of Overlapping Shifts - 8 class school working a 30 hours curriculum per five day week

		First over-lap			Second or major o/lap			3rd o/ lap				
	1	2	3	4	5	6	7	8	9	10	11	
Teaching Periods	8.00 to 8.45	8.50 to 9.35	9.45 to 10.30	10.35 to 11.20	11.25 to 12.10	12.15 to 13.00	13.05 to 13.50	13.55 to 14.40	14.45 to 15.30	15.40 to 16.25	16.30 to 17.15	
A	X	X	X	X	L	X	X					
B	X	X	X	X	L	X	X					
C	X	X	X	X	L	X	X					
D		X	X	X	X	L	X	X				
E		X	X	X	X	L	X	X				
F					X	X	L	X	X	X	X	
G					X	X	L	X	X	X	X	
H					X	X	L	X	X	X	X	

which is a striking feature of many Spanish secondary schools, can be made suitable not only for the presentation of plays, or for ceremonial assemblies, but also for religious worship, for dining and for gymnastics. Beyond this, however, teams have not yet ventured. There is no doubt that further study of dual use as an aspect of intensifying the use of school space is a field in which further research and development would allow significant economies to be made. The word "development" is important, since it implies practical application in a real situation. Dual use, like many aspects of school construction, is bound to demand compromise. Argument over which compromise represents the best balance of advantage over disadvantage can be endless if it is conducted in theory only: a decision needed for practical application cuts theorising short and leaves the argument to be settled more convincingly by real experience.

Reformed Academic Year

80. A further unexplored possibility is reform of the academic year to avoid leaving school premises unused throughout long holiday periods for 17 or 18 weeks every year. Long summer vacations may still be justifiable where children are needed for harvesting, but in urban societies there could be many educational and social, as well as economic, advantages in spreading the vacations more evenly throughout the year, making them shorter but more frequent. They could then be staggered as in the time-pattern shown below. The symbol XXXXX shows attendance at school, the blanks indicating vacations.

```
       3       3       3       3       3       3
     weeks   weeks   weeks   weeks   weeks   weeks

A    XXXXX...XXXXX...........XXXXX...XXXXX........

     B       XXXXX...XXXXX...........XXXXX...XXXXX........

             C       XXXXX...XXXXX...........XXXXX...XXXXX
```

The students are divided into three courses, A, B and C. Instead of all courses beginning their academic year at the same time, course B starts three weeks after A, and C three weeks after B. Each course works for six weeks and then has a 3 week break. There are thus always two courses in the school, but never three. In this way 50% more students can be accommodated over a given time cycle than would be the case with the traditional pattern. It must be emphasised that the adoption of such new patterns would not economise on teacher resources and this would need to be made clear if the opposition of teachers was not to be aroused. There is as yet no experience of such new patterns. But they hold the promise that the capacity of existing schools could be raised by 50% and the building bill for the children remaining to be accommodated cut by a third.

Extra-Curricular Use

81. Finally, and perhaps less radically, there is the possibility of using school premises for purposes beyond those of the curriculum and pupils whom they are primarily intended to serve. The introduction of language laboratories for example suggests the possibility of adult usage in the evenings. In certain parts of Yugoslavia the local community may make frequent use of the school gymnasium. Pursuit of the idea presents some difficulty if, for example adults have to use furniture designed for small children. Nor will any real economy result from extra-curricular use unless utilisation is maximised over the curricular cycle itself, and economies will be diminished if extra accommodation has to be added which is not fully used during the main part of the school day.

The Project a Field Laboratory

82. That so many possibilities have been left unexplored should not be thought a criticism of how the project was either conceived or carried out. Each team has been breaking entirely new ground, and previous experience in this field, tapped by OECD technical assistance, has been gained in countries with radically different economic, administrative, educational and technological conditions. Ideally a period of methodological study should have preceded the investigation, but without the experience afforded by it, the methodological problems could not realistically have been foreseen. Now that such problems have been identified and solutions to some of them found, there are strong grounds for continuing the work; but to have prolonged the project in the first instance would have been to run the risk of delaying achievements which even if interim in nature are nevertheless valuable.

83. Like its forerunner, the MRP, the DEEB project has in fact been a kind of field laboratory for the exploration of ideas. Hypotheses have been advanced, tested, found wanting and reconstructed accordingly. Nowhere is this more evident than in the field of standards and in the development of the curriculum load and overlapping shift methodologies. The basis of the curriculum load methodology was explored at the London Working Meeting in September 1964; but its implications were only revealed by mid-1965, in the course of the Secretariat's own study of the use of school building resources. Only by the time that study was completed (at the beginning of 1966) had the problems of over-lapping shifts come to light and the basis of a methodology for dealing with them been tentatively advanced; and it is only with the writing of the present paper that the mechanism of overlapping shifts and their curriculum space requirements has come to be fully appreciated. Thus the value of the DEEB project does not reside solely in the interim facts and recommendations it has brought to light, useful though these are; it consists equally in providing a launching pad for further exploration of the subject which, in the future, can be expected to prove even more fruitful still.

Promise of Future Research

84. Now that the basic mechanisms are more fully understood, there is obvious scope for much further research. This will need to be concerned not only with the search for more intensive utilisation, about which enough has already been said, but also with educational innovation not yet introduced but already foreshadowed. The aim of such innovation will be twofold - improvement in the quality of education, and more effective utilisation of the teachers. Pursuit of these twin aims is likely to affect space standards in two ways. First it will introduce new kinds of equipment and apparatus and new educational activities, demanding in turn different areas per pupil from those so far recommended. Secondly, it will hasten the process already discernible in some cases (the Spanish report provides examples) where the traditional class of 30 or 40 pupils gives way to a more diversified size of teaching unit, varying from perhaps two or three hundred pupils watching a television demonstration to groups of six or so working with a minimum of supervision or to individuals receiving personal tuition. As this trend is established the basic methodologies,

particularly those based on the curriculum load effect, will need considerable elaboration and refinement.

85. The methodologies have so far been susceptible to "manual" techniques evolved for comparatively simple curricula and time-tables as well as for a very restricted range of teaching size. The further elaboration and refinement needed as complications are introduced will take them beyond the point where manual techniques are adequate. The same is true of preparing the school time-table which in some countries has already become a task so complicated that only a computer can perform it. Determining the type and number of teaching spaces in a school, i.e. listing accommodation, is the other side of the coin for which computer techniques are both complementary and equally essential.

86. Problems which demand this degree of methodological refinement for their solution are not confined to the DEEB countries. Indeed, up to now they are more strikingly evident in the USA and the UK, and are particularly a feature of so called "comprehensive" education where a single school embraces an extended age range and numerous alternative curricula. Despite this, little progress towards the necessary methodological development seems to have been made in any of the countries concerned. This suggests that the potential value of or even the need for such an approach has not been fully recognised, and that by high-lighting the problem and elucidating its underlying principles the DEEB project has served as a seed-bed for ideas capable of much wider application - a fact which, if true, may encourage further international co-operation on developments which would greatly strain the resources of any single DEEB country working in isolation.

87. As the foregoing will have made evident, the work so far done on standards can not be accepted as having more than interim validity, and in the light of further investigation as well as of changing educational circumstances, the recommendations so far made will sooner or later need revision. In the vast field of activity still ahead of the teams lies considerable potential for future savings. Conversely, extravagant waste of resources would threaten future school development if the work should be abandoned. This is true in respect of standards alone; but as we shall presently show it is equally true in respect of the other, equally important, aspects of school construction which have engaged the attention of the national teams.

88. To sum up, there is a need for a range of uniformly accepted minimum standards of provision in respect of equipment, furniture and fittings, functional performance and teaching floor area: otherwise pupils will be denied equal educational opportunity. Standards must be related to educational policy and practice as well as to resource availability. Good practice provides the means of obtaining more from available resources in terms either of standards or of quantity or of the two in balance together. While the teams have made considerable advances in this respect, their proposals need to be checked, modified if need be, tested in "*écoles témoins*" and modified again in the light of experience; and further potential lies in possibilities which have still to be explored.

CHAPTER III: COSTS

A. Costs per School and per Pupil

Existing Variations in Cost

89. When the teams began their work nearly all countries knew that there was wide variation in the cost of their schools. They tended to regard costs as virtually unpredictable and to accept wide variation as the inevitable consequence. Most school construction projects were subject to approval of pre-contract estimates, but these estimates seldom resembled, nor were expected to resemble, the final real expenditure incurred by the time the building had been completed. Acceptance of such a situation has naturally militated against forward planning.

No one has know with confidence how much school accomodation a given outlay could be expected to purchase, and has thus been unable to say how soon effect can be given to proposals for educational expansion. Obviously if an educational system is to expand at a rate consistent with economic and social demand, an early remedy to cost uncertainty is needed. A way must be found of making forward estimates reliable and a system of cost control devised to ensure that estimated or planned expenditure produces, in the event, as much as it has been expected to.

Until and unless the recommendations of the teams are put into effect, and experience of their operation gained in practice, a definitive solution is unlikely to be found; but it is not too early or too optimistic to affirm that the teams have indicated the direction in which to proceed. At the same time their reports make clear that a solution can not be expected without changes in architectural, building and administrative practice which are bound to take some time and probably a degree of governemental pressure to bring about.

Importance of Cost Accounting

90. As School Building Resources points out (Chapter IX) the total cost incurred in bringing a new school into operation comprises the following:

i) Land purchase,

ii) preparation (earthworks, landscaping, etc.) and servicing (drainage, water supply, roads, etc.) of the site,

iii) the building proper,
iv) furniture, fittings and furnishings,
v) teaching equipment apparatus and books,
vi) capitalised running costs,
vii) overheads.

The teams found many cases where the above components could not be separately identified. There was sometimes doubt as to whether recorded expenditure covered all items and sometimes uncertainty as to whether all expenditure was included in the records available. Clearly the first step to be taken towards effective cost control is to establish a proper system of accounting. Most coutries are well-equipped for auditing accounts; but it is not enough to ensure that money has been spent on the educational purposes for which it is intended. For adequate cost control it is necessary to know how much has been spent on each purpose, as defined above. The school building authorities in each country need to give this matter early attention.

91. Special costing difficulties may sometimes arise in cases where official expenditure on a school is supplemented by voluntary contributions. The successful Greek emigrant will often contribute substantial funds to his old village school, perhaps to enable an unfinished building to be completed or to provide some item of equipment. Such contributions are seldom centrally recorded, so that it is impossible to tell how much provision to a given standard has actually cost. A similar situation occurs in Turkish villages when the villagers themselves contribute materials and labour to the building free of charge. The cash value of this contribution is again not put on record, with the same result.

92. Of the seven components of capital expenditure listed above, item (v) lies beyond the scope of the DSBB inquiry. Item (vi), capitalised running costs, is a novel concept to which attention was drawn at the 1964 Working Meeting. The concept recognises that savings on capital expenditure may, in some instances, raise subsequent running costs, and from this a case can be argued for converting running costs into a capital equivalent in order to make projects more strictly comparable. The subject is treated at length in School Building Resources, Chapter X, but the teams have not so far been able to take account of it, partly because of several unresolved

controversies affecting it, and partly for want of data.

93. Land purchase is an item of costs on which the teams have little to recommend, since land costs depend so much on local market conditions. But their work suggests that if school site procurement were planned further ahead than is currently the practice rising land prices might be to some extent forestalled. There is a strong case in urban areas for site provision generous enough to allow for expansion as the trend towards urbanisation continues, since extension of or additions to existing schools is likely to be significantly more economical than building entirely new ones, as the discussion of school capacity in the previous chapter will have indicated. Where market prices have reached prohibitive levels the provision of school sites should be included in any consideration that might be given to land reform.

94. Item (ii) of the listed costs - the preparation and servicing of the school site - is important to distinguish from other building costs because it is so clearly liable to wide variation, depending on the topography, geological conditions, the proximity of existing services, etc. Here, however, teams encountered a major difficulty in that work on this item is usually carried out as part of the contract for the school building itself, the costs of the one being merged indistinguishably from those of the other. In making an apportionment the teams were usually obliged to resort to estimating based on what were inevitably assumptions rather than clear evidence. For future cost control it is most desirable that builders' estimates and accounts should make clear how much is incurred on the building proper and how much on additional construction costs. (For definitions see op.cit chapter IX).

95. Despite the difficulties mentioned, there is little doubt about the main conclusion to be drawn about additional costs: that, except where existing roads and services are so remote that connections to them exceed 30m. or 40m., additional works are not likely to account for a significant proportion of the total constructional costs. In the United Kingdom they amount on average to about 10%: in the DEEB countries appreciably less additional construction is normally carried out, but taking account of the comparatively modest standards of construction in DEEB schools the percentage is probably much the same.

96. These extraneous items apart, the cost of the building proper (item iii) is obviously dependent on its size, expressed most conveniently in terms of floor area, and on the cost per square metre of that area.

Gross Area as a Component of Cost

97. As the previous chapter has shown, the DEEB teams have found that disparities in gross floor area far exceed those in the educational activity area contained within it. From this it follows that if the ancillary area (i.e. the balance between educational and gross) can be controlled, the gross area needed to contain a stipulated minimum of educational area need not exceed a certain maximum. Control over ancillary area is therefore the first step the teams recommend in the direction of control over costs. These recommendations are quantified in Table 4. In every case they represent a considerable reduction on the areas found in examples analysed, as comparison of Table 4 with Table 1 will show. Where it has previously been commonplace to find ancillary area equal to or even exceeding the educational area of a school, the teams have found that an area not exceeding 60% of educational area is sufficient for ancillary purposes. Ingenious and skilful planning may mean that even less is needed.

98. At the same time it must be remembered that by applying the curriculum load methodology, the teams have also shown how the same educational purposes can be satisfied with less educational area, so that this, too, is a notable step towards cost reduction.
To take an example not particularly favourable to the argument, the 8-class school in Table 3 (d) has a total educational area of 769 sq. m. Adding 60% to this figure produces a gross area of 1230 sq.m. If the curriculum load technique had not been applied the school would have had eight general classrooms (one for each class) instead of three, and this would increase the educational area by 277.0 sq.m. to 1046 sq.m. Without control, the added ancillary area might easily be a further 80%, giving a gross figure of 1882 sq.m. Thus curriculum load technique in combination with control over ancillary area shows a saving on previous practice of some 34%. In examples more favourable to the argument, savings of 50% or 60% would not be rare. No other source of cost reduction is as potent in its effect.

99. The foregoing example does not, of course, take account of potential savings from the overlapping shift. As we have seen, the use of this technique, combined with dual use, would reduce the educational area to 530.4 sq.m., which with 60% added could be contained in a gross area of 848 sq.m., representing a saving over the "conventional" 1882 sq.m. or nearly 55%.

Costs per Square Metre

100. All teams found wide variations in costs per square metre. (see Tables 6 and 7). Prior to the DEEB investigation the tendency had been to attribute this to unstable market conditions. In consultation with OECD experts, however, the teams agreed that variation could equally be attributable to other causes, the nature of which is discussed at length in School Building Resources Chapter V. To test this hypothesis the overall costs per sq.m. of a large number of projects were analysed in terms of constructional elements, (walls, floors, roofs, etc.) of which the buildings are made-up; so that, for example, out of a total figure of 5,000 pesetas per sq.metre, 1500 pesetas were spent on external walls, 1200 pesetas on the roof and so on. Analysis of this kind was expected to show, as indeed it did, that differences in cost were largely attributable to differences of choice, i.e. to the constructional alternative selected by the architect when the building was designed.

Problems of Cost Analysis

101. Elemental cost analysis of this kind was first developed in the United Kingdom, and the techniques involved (described at length in School Building Resources Chapter VII) were examined by teams at their working meeting in London in 1964. The techniques as examined were, however, closely interlinked with contracting practices specific to the United Kingdom. These practices require that every builder who bids for a contract shall not only submit a total price but shall separately price every item to be built under the contract, each of which has been specified and quantified beforehand in a "bill of quantities". This bill of quantities is so detailed that the total price can easily be analysed in terms of the various structural elements of which the building is composed. Contracting practice in the DEEB countries, at least as it concerns schools, uses what is by comparison only a rudimentary bill of quantities, and it is used quite

differently. Against each item the architect - not the builder - puts down what is considered to be a fair price, calculated on official or semi-official material and labour costs. The total price so calculated is then communicated to competing builders who put their bids in the form of a discount on the official fair price, the contract being awarded to the builder offering the largest discount. There is no means of knowing whether the discount would have been the same for individual items and thus no means of knowing the real market price of any one of them. This combines with the rudimentary character of the "bill of quantities" to make cost analysis in the DEEB countries much less precise, and in some cases (where, for example, the bill makes no distinction between concrete in walls and concrete in floors or in roofs) cost analysis based on market prices is impossible.

102. The Secretariat's own study has shown how vital cost analysis is to effective control over school building expenditure, the case being argued at length in School Building Resources Chapter XI. Experience in the DEEB project has confirmed this view and several teams have accordingly recommended that contracting practice should be changed with a view both to increasing the amount of detail given in the "bill" and to ensuring that contractors price each constituent item as well as the total. The Spanish team have made a notable contribution to cost analysis with a methodology specially adapted to contracting and pricing techniques in their own country.

103. Difficulties of the kind described have not deterred teams from attempting detailed cost analysis, and where information based on market prices has proved unobtainable they have resorted to estimating. The inevitable difference between estimates and real contractors' prices is an indication of how far their conclusions need to be treated with reserve. On the other hand, analyses based on estimates have at least the advantage of sharing a consistent basis, and there is no need to question the validity of the first conclusion drawn from them: that much cost variation is due mainly, as we have said, to different architectural interpretations of what constructional alternative or combination of alternatives should be selected; and partly to differences in quality and to the scale on which certain items - such as sanitary fittings or heating and lighting installations - have been provided. In short, differences in cost

per sq.m. are largely the result of inconsistency of standards.

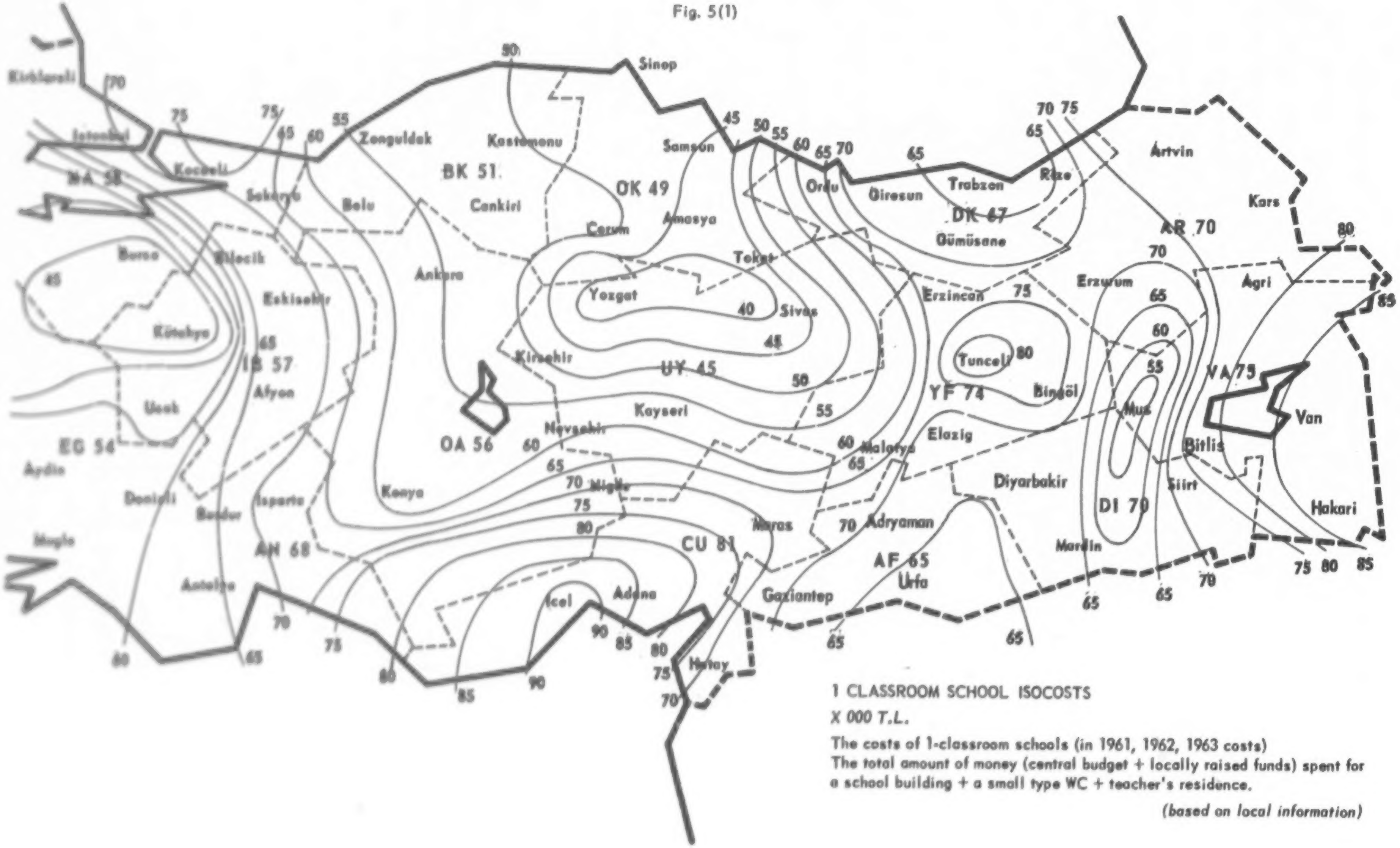
104. This is not to say that some difference may not be the result of local variation in price levels and costs, although lack of reliable market information has made the truth in this respect difficult to ascertain. Such local variations seem most serious in Greece and Turkey. The Greek team has analysed labour and material costs in five different regions of the country, and using the Athens area as a datum, have found that real school building costs (for constant standards) are 5.2% higher in other urban areas, 15.9% higher in non-urban plains, 35% higher in mountainous areas and 51.9% higher in the islands. The Turkish team has made a similar analysis relating to cost per sq.m. in each of the 67 Turkish provinces and has found coefficients of variation ranging from 0.771 to 1.314 (i.e. variations range from 22.9% below datum to 31.4% above it). At the same time, the Turkish report also includes some interesting maps showing cost contours or isocost lines drawn for the whole of Turkey (see fig.5).from which the cost of three classroom schools appear to vary between 65,000 T.L. and 235,000 T.L., and one-classroom schools from 40,000 T.L. to 90,000. Thus the range shown on the isocost maps is inconsistent with the coefficient of cost per sq.m. This inconsistency is not explained in the Turkish report, but the probability is that it results from inconsistency in the standards of accomodation provided.

Cost Recommendations

105. The close relationship established between costs and standards confirms the Secretariat's own study (op.cit.Chapter V). and has led the teams generally to two recommendations: first that standards should be clearly defined, and secondly, that their own recommended standard implies a corresponding standard of expenditure per sq.m. to provide for it. The recommended levels of expenditure per sq.m. are shown in Table 7. Where regional cost variations are serious the levels shown would be medofied by the coefficients of variation which have been established.

106. With this the teams have completed what is in effect a trio of recommendations which, if put into effect, would ensure that value for money in school building was obtained and that costs were adequately controlled. By establishing gross areas and levels of cost per sq.m. they have been able to recommend a maximum limit of expenditure

Fig. 5(1)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Bolu
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OA 56
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IB 57
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Usak
EG 54
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AH 68
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Erzincan
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YF 74
Bingöl
Malatya
Elazig
Adryaman
AF 65
Urfa
Diyarbakir
Mardin
DI 70
Erzurum
AR 70
Artvin
Kars
Agri
Mus
Bitlis
Siirt
VA 75
Van
Hakari

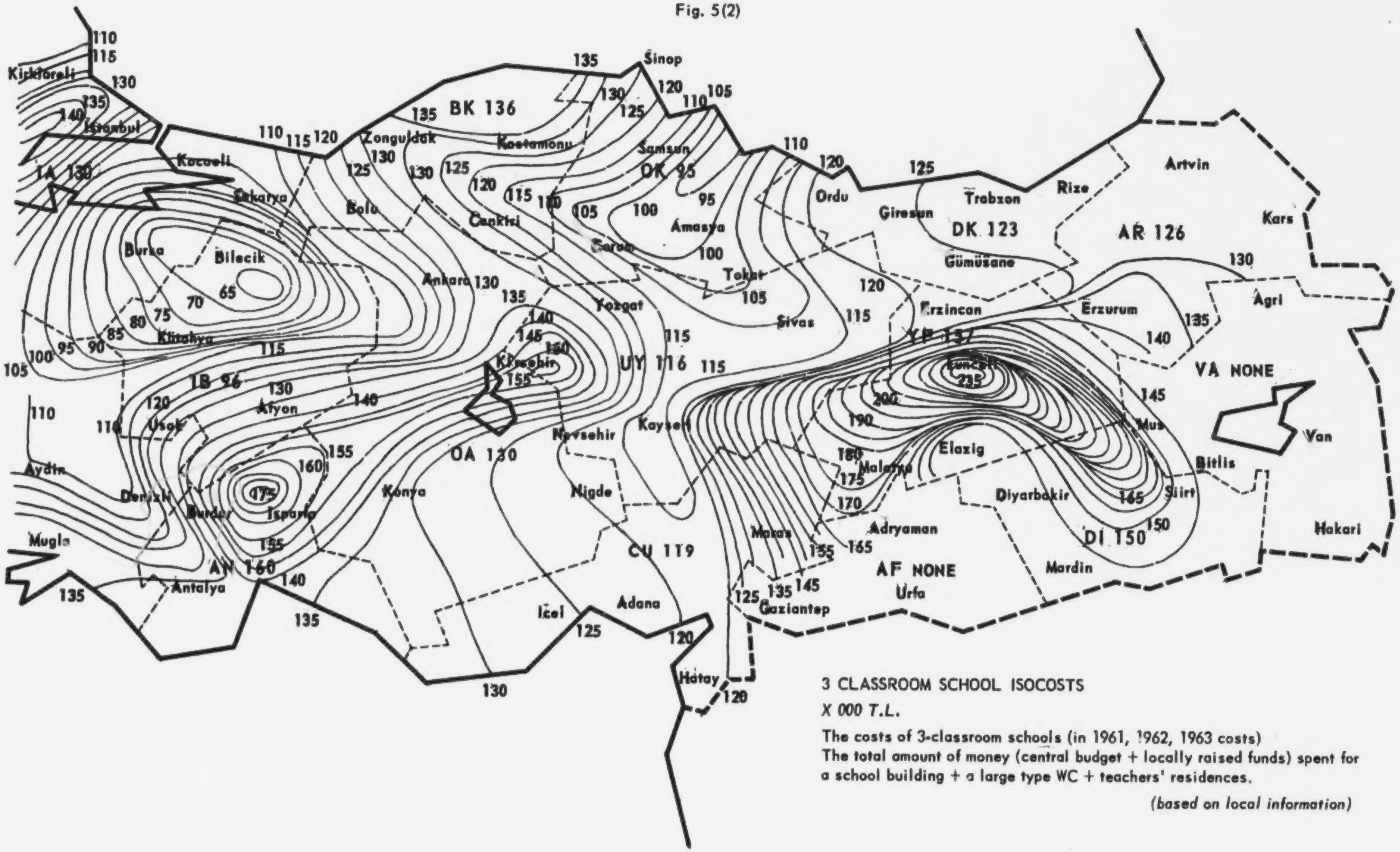
1 CLASSROOM SCHOOL ISOCOSTS

X 000 T.L.

The costs of 1-classroom schools (in 1961, 1962, 1963 costs)
The total amount of money (central budget + locally raised funds) spent for a school building + a small type WC + teacher's residence.

(based on local information)

Fig. 5(2)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Kayseri
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IB 96
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YP 137
VA NONE
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CU 119
AF NONE
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3 CLASSROOM SCHOOL ISOCOSTS

X 000 T.L.

The costs of 3-classroom schools (in 1961, 1962, 1963 costs)
The total amount of money (central budget + locally raised funds) spent for a school building + a large type WC + teachers' residences.

(based on local information)

appropriate to the school in question; and corresponding to this they have recommended minimum standards of performance and construction and minimum totals of educational activity floor area.

107. In principle these recommendations are incontestable. Nevertheless, warning is needed against applying them too rigorously or expecting from their application too early or too much success. Their quantification is based, as we have seen, on much data that are less than wholly reliable, coupled with a number of assumptions which may need modifying with experience. Additionally, their successful application demands a number of changes in current practice. If schools are to conform with the limits of expenditure and minimum standards recommended, much closer attention will need to be paid to details of constructional design and to their cost implications than is currently the practice and much more data on building costs will need to be accumulated and their meaning analysed. This is an aspect of school building on which considerable further study is urgently needed and we shall return to it under the heading of Implementation. In the meantime, the recommendations would be most prudently regarded as guide lines, divergence from which can be progressively reduced as experience is gained.

Costs per Pupil

108. That costs per pupil should vary according to level and type of education is only to be expected. As we have seen, however, gross floor area per pupil is variable, even for a single level and type of education, according to the number of pupils in the school. Costs per pupil, dependent as they are on gross area, vary similarly (Table 4). This is of no great concern in controlling the cost of individual building projects, but the educational planner or administrator attempting to forecast the costs of educational expansion is bound to be inconvenienced for lack of a single representative or average cost per pupil.

109. The only wholly accurate way to arrive at an average cost per pupil is to determine how the total number of pupils to be accommodated is to be distributed among schools of different pupil capacity -i.e. how many in 400 pupil schools, how many in 800 pupil schools, and so on, for each type and level of education. Unfortunately, at the stage when global forecasts are required, information of such a

detailed nature is unlikely to be available.

110. This raises immediately the question of what governs the capacity of a school. The previous chapter has shown how, in relation to a given curriculum, full utilisation of teaching space is easier with certain sizes of school and, although there are exceptions, (see School Building Resources Chapter III) there is a general tendency in favour of the larger school. To regard intensity of use as the sole criterion for size of school could, however, be wasteful rather than economic. First there is the fact that the time of teachers needs to be used as economically as possible, and there is an obvious affinity between the intensive use of buildings and, so to speak, the intensive use of teacher resources. Let us assume, for example, that a specialist teacher of, say, science can carry a load of 24 hours per week of class teaching - remembering that he has to prepare his material, mark exercises and so on. A curriculum load which uses the science laboratory for 30 hours per week will produce an economical use of space, but will produce an uneconomical use of science teachers. Two will be needed, be capable of carrying a 48 hours load between them, yet will be required to carry a load of 30 hours only. Here it is impossible to do more than draw attention to the question. The teams have not solved it, although the Greek team has examined it and has tentatively indicated the possibility of having itinerant teachers. Thus a further topic for future study is the compatability between the intensive use of building resources with that of teacher resources.

111. Then secondly, whichever of these two considerations proves decisive, waste will occur if the resulting capacity of a school is greater than its recruitment area can fill. Here again is a question which no team has been able to give adequate attention: what are the factors governing extent of recruitment area and what school population will that area support? The question is clearly closely dependent on demographic studies made in the light of urbanisation trends, and needs to take account of pedestrian or vehicular communication within an area as well as of population or housing densities.

112. The trend towards urbanisation, coupled with the inability of small villages to provide sufficient pupils to occupy a single full-time teacher, not to mention the number of teachers needed to cover specialised subjects, poses enormous problems for the DEEB

countries. The question frequently arises of providing some form of central facility serving separate settlements, a question which likewise involves problems of location. Appendix III of the Turkish report is an attempt to establish the criteria governing location and to devise a mathematical model for handling them.

113. The problem of school size and therefore costs per pupil is thus one which, perhaps unexpectedly, brings architectural planning, educational planning and geographical planning into a common focus; and it is one which demands for its solution the closest links between decision-makers in each of these three fields. The full significance of this was not realised until near the end of the project. For this reason any figure which is used to represent the average cost per pupil in any particular sector of education is bound to rest on a number of assumptions, all of which will need vigorous testing and possible revision in the light of subsequent experience.

114. In implementing a school building expansion programme, this element of uncertainty about average costs per pupil need not be as serious as might be supposed. The project has clearly shown that if costs per pupil are subject to a wide range of variables, these variables represent, in effect, options among which policy-makers may choose. In ascending order of importance these options concern :

(i) Standards of construction and performance;
(ii) Standards of area for different educational activities;
(iii) Size of class appropriate to different activities;
(iv) Degree to which accomodation is specialised or capable of dual or multiple use;
(v) Range of curriculum choices;
(vi) Numbers enrolled in school;
(vii) Length of school day and consequent school organisation;
(viii) Work/vacation pattern of the academic year.

If, in practice, costs are found to vary from their expected level, it would appear that the output from a given level of investment can still be maintained by slight adjustments between options.

115. Table 8 gives the best estimate possible of average costs per pupil for each country and for each section of education so far studied. The assumptions made in arriving at the estimate are given in

the notes accompanying the Table. Table 9 compares the recommended cost levels with existing ones.

Cost Index.

116. A final important factor for the control of costs is the establishment of a satisfactory and reliable index for the objective measurement of changes in price level. Teams have had resort to various mechanisms of this kind in analysing school building costs incurred over an extended period of time, but none has been wholly satisfactory. Existing indices have several shortcomings. Some are for materials only - others for wages only. Where they take account of materials and wages together the labour/material mix is usually related to housing and is not necessarily appropriate for schools. Finally while reflecting market changes in labour and material prices, the indices ignore the supply/demand effect in bid levels. Of existing index systems the teams have found most worthy of study the Spanish method described in School Building Resources Chapter VIII Appendix although this does not remedy the last-named defect. Thus the establishment of reliable bid level indices remains a subject needing early attention for the proper control of school building costs.

B. Total Costs

Number of School Places Needed

117. Having determined the cost per pupil, the next question is how many new pupil places are needed? Considering the effort invested in the educational planning of the M.R.P., the teams might have been expected to find this answer ready to hand; but in fact the question proved to be fraught with numerous difficulties, not all of which are yet resolved.

118. First, a definition: a pupil place is the amount of accommodation needed for each pupil enrolled in a school where the total number of enrolments is the maximum number of pupils who, without overcrowding, can follow the curricula of the school.

As chapter 2 has shown, whether all enrolled pupils are present simultaneously in the school is irrelevant, and for this reason the area or cost per pupil place will differ widely according to whether or not any kind of overlapping shifts or system of staggered hours is practised. Also a pupil place is quite distinct from a place at a desk or at a workshop bench, the number of which is no indication of how many pupils can follow a curriculum in the course of the working week.

119. Although meaningful definition is impossible without reference to a maximum number of enrolled pupils, not all schools will invariably have this maximum number on their roll, since the annual number of births in a recruitment area seldom accords exactly with administrative convenience. For the same reason, there may be occasional years when the number enrolled marginally exceeds the maximum, but the excess would have to be more than marginal, and continuing rather than sporadic, before the school could be regarded as overcrowded. Marginal and occasional excess of numbers can probably be expected to cancel out marginal and occasional shortfalls.

120. The Greek and Spanish teams excepted, there has been a tendency to regard the required number of new pupil places as equal to the expected number of new entrants to the educational system. The real figure, however, is likely to be higher, as will be appreciated when the following factors are taken into account.

(a) Migration and Overcrowding

All countries need new school places simply as the result of population movement to areas such as new housing developments which have previously been without shools of any kind or without suitable schools. Such movement may be occasioned both by drift from rural to urban areas, (a marked feature of the DEEB countries) and by movement from derelict or decaying areas within urban agglomerations themselves. The result will be an irreversible reduction of usable places in the existing stock of schools, leading to overcrowding of the usable places which remain. Thus new places are needed both to provide for expected future migration and to relieve overcrowding due to migration which has already occured.

(b) Sub-standard schools

Some existing schools will probably be seriously and irremediably substandard. Some of these will be included among the places made irreversibly unusable by emigration. The remainder will further deplete the real value of the existing stock of schools.

(c) Intensified Use of Existing Stock

The stock of schools remaining after unusable or sub-standard buildings have been written off will probably contain a range of accommodation which is out of balance with the curriculum load.

By suitable adaptation or, where possible extension, the enrolment capacity of this remaining stock could be considerably increased.

121. The real number of new places required by year t may thus be represented by the following formula.

$$N_t \quad P_1 + E_t - \left[N_1 \left(1 - \frac{nt}{100}\right) + A \right]$$

where N_t = number of new places required by year t,

P_1 = number of pupils in system at year 1,

E_t = number of new recruits to system by year t,

N_1 = number of pupil places, as defined above, existing in year 1.

nt = percentage of N_1 expected to be unused (i.e. rendered redundant by migration) or/and irremediably sub-standard by year t.

A = additional places made available in existing schools by improving balance between accomodation and curriculum load.

122. Here emerges a wide field of study to which virtually no attention has so far been paid but which is essential if school building resources in the DEEB countries are to be effectively used. First is the need to take stock of existing school resources and to estimate how many schools will have become irremediably sub-standard or rendered redundant by migration by a given future year. Then a survey is needed of those that remain - $N_1 \left(1 - \frac{nt}{100}\right)$ leading to a decision on what adaptations or additions can be made to them and what extra number of pupil places (A) will then result. Such a decision will naturally require and take account of careful cost-benefit analysis. The probability is, however, that the provision of extra pupil places by this means would be speedier and cheaper than the equivalent new building, and participating countries can expect substantial benefit from according priority to an investigation on these lines.

Cost of new pupil places needed

123. The total cost of all new places needed is thus the cost of Nt + the cost of A. For this reason the building costs of educational expansion as estimated by the teams is no more than an interim estimate, being based (except in Greece and Spain) on the assumption that the number of new places needed would equal the number of new entrants to the

system. Despite the cushioning possibility of intensifying the use of existing stock, factors of migration, redundancy and sub-standard stock suggest that teams have probably under-estimated the amount of financial resources needed rather than the reverse. This being so, the total savings resulting from their recommendations are likely to be even greater than might be thought. However, accepting the teams'assumptions as the only estimates yet available, some examples of the investment required at a given level of education and the savings likely to accrue from the teams'recommendations are shown in Table 10. Continued investigation is likely to produce even greater economies.

Limitations on Study

124. Taking account of the pioneering nature of their work the teams could not be expected to cover, within the time limits of the project, every type and level of education in the national system. The expectation was that they should examine as much as time permitted and that, having established the validity of their modus operandi, they would continue to receive support from their authorities without further financial contributions from OECD. In examining the effect of the teams' recommendations on resource requirements, information is therefore only available in respect of the particular sector studied. Continued investigation, not only of those topics already mentioned as meriting further investigation but also of sectors of the system not yet studied, would produce information on total financial requirements which would be invaluable for further investment planning.

CHAPTER IV: IMPLEMENTATION

The Size of the Problem

125. The bare figures for required new places as given in Table 10 in no way reveal the magnitude of the problem which the expansion of school building imposes on most DEEB countries. Leaving aside the fact that most of the figures represent what is probably an under-estimate, even the average level of output needed is striking enough; but to this must be added the fact that in the early years of the decade, when the programme is still gathering momentum, output will probably not succeed in reaching the level required, so that it must rise to well above the average in later years if the required expansion is to be provided on time. This was certainly the experience of the United Kingdom which, as is well-known, put considerable effort into its successful post-war school building programme. Admittedly, economic difficulties associated with the immediate post-war period were exceptionally acute, but probably no more so than those with which the DEEB countries are familiar. As an indication of the acceleration in output which may be needed, table 11 shows the number of new places which would be needed each year if the DEEB countries were to achieve the same rate of output.

126. Obstacles to this acceleration are formidable: shortage of money, shortage of professional skills, shortage of craft skills, and with steel and timber - the materials which can do most to offset the effect of these shortages - either in short supply themselves or prohibitively expensive for school construction. Not all countries suffer shortages to the same degree, although parts of Greece, Turkey and Yugoslavia suffer the additional disadvantages of poor or non-existent road connections. And in every case migration to urban areas means that school building is most urgently needed in those areas where new housing and industry compete for whatever resources are available. This is the background against which the problems of implementation must be examined, and it clearly leaves no room for waste or dissipation of resources, either of finance, manpower or materials at any stage in the implementation programme.

Educational Policy

127. No significant expansion of school construction can be intelligently planned unless certain basic issues of educational policy have first been settled. Such a declaration is no doubt trite, yet a number of teams have been hampered in their work by uncertainty about the direction educational policy could be expected to take. Here indeed, is something of a dilemma. The same social and economic demands which prompt the need for school expansion, prompt equally the reconsideration of educational policies, - so that it is unavoidable and to be expected that building decisions should be urgently needed at the time when new educational policies are still under discussion. In this respect the DEEB project has revealed an unexpected role for school building. As the tangible element in educational expansion, it has a role as pace-maker. The expansion cannot take place if the schools are not ready in time, and the schools will not be ready unless fundamental decisions about them are taken early enough. Seen in this way, school building inserts a critical date into the calendar of decision-making, beyond which further policy discussion will tend increasingly to defeat its primary objective. If educational expansion in the DEEB countries is to take place at the rate which the M.R.P. regarded as desirable and necessary, that critical date has already now been passed.

128. Not all details of educational policy need be decided by this critical date, but the following are essential.

(i) What types of school are to be built? This question is not synonymous with what kind of institutions are to be housed. To indicate an example without suggesting in any way what course should be taken, let us imagine on the one hand, a non-vocational secondary school oriented primarily towards crafts and technology, and on the other, a grammar-type secondary school oriented towards university entry. As institutions the two are entirely separate and distinct, but since much of the accommodation needed for the one would be equally suitable for the other - and might, indeed, allow its range of activity to be usefully extended, many advantages could, conceivably at least, result from the two institutions sharing common premises. The institutional location of the Portuguese "observation cycle" is a question of this order. Another is the possibility of making provision for special studies in a central building, while general subjects requiring less highly qualified teachers or less expensive equipment are taught in local outposts. In this connection, some prior investigation, based on the curriculum load technique, may well need to precede the decision which is eventually taken, since the relative economics of such a proposal would need to be weighed with the educational, social and political factors.

(ii) What criteria are to govern the extent of recruitment areas? What is the maximum daily journey time from home to school which is considered tolerable? What is the maximum percentage of pupils who should have to make a journey of maximum duration? How long should the longest journey be for the remainder? Is special transport to be provided to bring pupils to school from outlying areas? These are questions of educational policy which it is necessary to answer before the extent of recruitment areas and their consequent enrolment figures can be assessed. In Greece and Spain they are intimately linked with the rôle played by the private sector in education, due consideration being given to how far it can relieve the public sector and to avoiding duplication by the one of efforts made by the other. The extent to which practical circumstances allow or prevent consistency in recruitment area policy throughout a country is, incidentally, one indicator of disparities in educational opportunity. No team has addressed itself to these questions, but the work of all of them underlines the urgency with which answers to them are required, particularly for the extension of secondary education which is so widely needed. The topic is another instance of the place of school building in the wider context - by generating questions it is inevitably a generator and focus of policy.

(iii) What policies are to be adopted for intensifying the utilisation of school premises? Possibilities have been discussed in Chapter II.

(iv) What policy is to be adopted for the employment and deployment of teachers? The tradition, strong still in several DEEB countries, that almost every professional person holds two jobs and arranges hours of one to suit the other, whatever its virtues as insurance against unemployment or monotony, certainly appears to any one not bound by it as wasteful both of time and resources. This is particularly so where specialised and expensive school facilities are concerned, since to all other constraints on their full utilisation must be added the limited availability of certain teachers. In some countries the number of hours per week which a teacher is obliged or allowed to teach a class is limited by statute. Presumably the intention is that he should have sufficient time remaining, not only to recuperate his energies, but to prepare his work. If so, the intention seems often defeated by dual employment, and there are numerous cases where school buildings could be much more efficiently utilised if such teachers were required to spend at least as much time in school each day as the pupils they teach. The deployment, as distinct from the employment, of teachers is closely tied with the enrolment capacity of recruitment areas and with the consequent curriculum load placed on scarce specialised teachers. If the load is less than the teacher's capacity, is he to spend his remaining time teaching a subject where his speciality is not needed and where a less qualified teacher would be equally capable? If this is thought wasteful, is it feasible that he should teach X days at one shool and Y at another, or is it better that, together with other highly specialised colleagues, he should remain always at a centre of the kind mentioned in sub-para. (i)? The answer will depend on the balance of capital costs against the cost of teachers and transport - another instance where some kind of school building investigation needs to precede a policy decision which in turn is essential to school building implementation.

(v) Closely linked with the previous question is that of teacher supply, the consequent pupil/teacher ratio, and depending on the teacher's weekly class-hours, the average size of class. Without decisions on this point, standards are impossible to formulate definitively, and where such decisions are still pending, team recommendations involving class size will need subsequent checking and possibly revision.

(vi) Finally, but not least important, curriculum policy for each type of school or for each institution served by a school building, must be decided. For an implementation programme to be satisfactorily outlined, the precise detail of the curriculum need not be be determined, and as we have already noted, plans which allowed for no curriculum adjustment would in any case be ultimately wasteful. But the broad balance of time to be spent by each grade of pupil over the broad range of specialities should at least be known.

Location and Priority Planning

129. The work of teams in all countries suggests that somewhat haphazard criteria are used in determining where new schools are to be built. One result is that even in countries where many schools are grossly overcrowded some of the new ones are hardly more than half filled. In other cases attempts to ensure the most equitable distribution of available resources has meant that they are dissipated by being spread too widely. And although the MRP has encouraged all countries to look ahead to their future educational needs, none yet seems to have begun the task of translating overall national forecasts into local terms. If school building resources are to be used as effectively as possible there is little doubt that development plans are needed to determine the location of each school to be built under the expansion programme and, since all can not be built at once, to settle which shall be given priority.

130. A notable step in this direction has been taken in Spain,where, the team reports, "the Direccion General de Ensenanza Media (Grammar Schools) has undertaken a vast and detailed study at the national level with the object of collecting all the information required in the programming of the investments foreseen in the framework of the second two-year period of the present and eventual National Economic and Social Development Plans. This is an extremely complete, province by province, study of requirements, in which due consideration is given to natural regions, geographical zones, transportation facilities, population and economic, educational and social conditions. In our opinion the only drawback of this study is that it should have been restricted to General Secondary Education and therefore does not cover secondary education as a whole, nor, for that matter, any other educational level."

131. The preparation of development plans either nationally or regionally is an urgent need in all countries. Such plans will need to take as a starting point the existing stock of schools and their potential contribution to the total number of pupil places required.

(A notable feature of the work carried out by the Turkish team is an educational atlas of their country showing the existing situation for each of the 67 provinces.) Based on forecasts of population movement resulting from expected developments in agriculture, industry, transport and housing, the plans will need to delineate recruitment areas consistent with educational policy. In this way school building becomes the tangible link between education, general economic development and territorial planning.

Staged Developments

132. A further aspect of development plans is that they need to aticipate the likely rate of growth of the school population in each recruitment area, so that schools can be built in stages and in step with (or rather just in advance of) population growth rather than remaining only partly filled over a long period of years. The Spanish report observes:

> "We believe that in educational planning due consideration should be given to the possibility of erecting extendible or growing buildings. If population data are dependable they will by themselves provide the growth indices of the student population of each establishment. On the basis of these indices and with an end to meeting the short-term needs of a larger number of municipalities, it would be, in our opinion, more advisable to build a larger number of smaller educational establishments, which may eventually be enlarged, than to erect bigger establishments, with a view to long-term demand in a smaller number of catchment areas.
>
> The application of this criterion permits architects to design buildings with due consideration to eventual enlargements. The only requirement is that the ultimate building should be shown at the rough sketch plan stage, as well as the eventual construction stages foreseen by planners with due regard to the directives of educators."

A report from the Slovenia Republic Secretariat for Education says:

"A serious economic feature which has not been taken into consideration so far is building in stages. Usually the investor, fearing that the newly-built school will soon become too small, builds an over-dimensioned school building. This burdens the community to a substantial extent with a too high initial capital investment and with a too high subsequent maintenance cost (which is not necessary at all in the initial phase). Owing to this one of the basic criteria for organised building has been flexibility in school designing, so that the grouping, form and structure of the different parts may permit addition at will of the subsequently necessary accommodation without any essential increase in cost and without any disturbances in function. This permits the solution of momentary problems with a lower initial investment and the later adaptation of the building to the new needs."

Suitable techniques for building schools in stages deserve attention in all countries. In this connection it should be noted that in the early stages some accommodation will usually have to be provided which, being indivisible, will inevitably be underloaded until subsequent stages are complete. Thus the cost per pupil accommodated will be higher than average in earlier stages, although, as the Spanish report points out, places in a half-filled school would cost twice as much; and in any case the average is restored by correspondingly lower costs per pupil in later stages.

Co-ordination of Interests

133. For various political or historical reasons, responsability for school building may be shared among a number of institutions or interests whose efforts it will be desirable to co-ordinate in preparing plans for location and priority in school building. In Spain, for example, educational policy is based on the expectation that one third of the new places required will be provided by the private sector. The efficient use of resources may not always be the consideration which over-rides all others; nevertheless its importance certainly suggests the need for some measure of co-ordination between the two sectors if one is not to duplicate the effort of the other. Greece, too, is a country where the private sector contributes substantially to the provision of school facilities. Recommendations in this respect lie outside the terms of reference of the teams, but

their work reveals the need for some consideration of the topic.

134. Yugoslavia provides an example of another order in that responsibility for elementary education is wholly and exclusively the responsibility of the smallest unit of government, the commune or municipality, and is subject to no central direction at either Republican or Federal level. Any co-ordination of these local authorities can therefore only be on a voluntary basis. The Secretariat for Education & Culture of each republic nevertheless acts as a channel through which co-ordination may be effected, and since the team began its work great progress has been made towards it. (See also para.147 below).

135. Alternatively, co-ordination may be needed between two or more departments of government. In Portugal the DEEB team itself consisting as it has done of Architects and engineers from the Ministry of Public Works and educationists and administrators from the Ministry of Education, has marked a further step forward in co-operation between two ministries where co-operation was already well-established. The Turkish recommendations include a proposal for "a permanent body to direct and/or co-ordinate all activities related to school construction, responsibility for which is divided between the Ministries of Education and Public Works, their provincial directorates, and the provincial governors. The Spanish report proposes that a single unit should assume responsibility for school building which at the moment is shared by several Directorates of the Ministry of National Education. In Greece responsibility has for some time been concentrated in the one Organisation for the construction of schools.

Financing

136. The teams were not expected to suggest how the finances needed for school building should be raised. Nevertheless assuming that most of the finance will have to be borrowed, it may perhaps be informative to examine the current cost which represents repayment of a loan at fixed rate of interest over different repayment periods. In this way it is possible to see building costs in relation to current costs per pupil.

137. The aspect of financing on which all teams agree is the necessity of ensuring that no project is started unless the finance needed for its completion is assured, since nothing is more wasteful than having to halt building process until extra finance is obtained.

The money which has already been disbursed remains unproductive in the meanwhile, and extra expense is incurred by the necessity to remove labour and plant from the building site and subsequently bring them back when operations recommence.

138. From this follows first the necessity that the final and total cost of every project should be accurately estimated before building work begins. Secondly, with the total amount of finance available limited over a given period, no more construction should be undertaken than the finance will cover; and as a consequence each individual project should be subject to a financial limit representing its due share of the finance available, and building work should not begin without the assurance that the building can be completed for an expenditure inside that limit.

139. An aspect of finance which is neglected in almost every country is the need to make adequate provision for running the building once it has been completed, and keeping it in good repair. Capital for building is often provided by a central authority, whereas running costs - heating, lighting and repairs - fall on small and usually poorer local authorities who are unable to carry the extra burden which the new building has imposed upon them. It is of the utmost importance that building projects should not be embarked on unless finance is available, not only to complete and equip the building, but for properly maintaining it thereafter. The Greek proposals on this are worth noting:

> "It is advisable for each school to have an allowance of petty cash to finance simple repairs necessitated by everyday wear and tear. The headmaster could then call in a suitably qualified technician, for example a plumber, carpenter or glazier, or invite estimates from local artisans. In the case of more important repairs, which would necessitate proper supervision, it would be best for each district to have under contract a permanent contractor for repairs and maintenance, who would operate on the basis of a single unit price schedule irrespective of the items of work needed at each school. This system should be organised through the local supervisory services, in respect both of technical guidance and instructions for repair work and of the formal procedures required."

140. Finally, teams draw attention to the desirability of allocating finance to individual building projects well in advance of the start of building operations; and it is, of course, a corollary of predetermined limits of expenditure and full cost control that the amount of allocation should be known before architectural design begins. The amount of time needed by professional personnel on the one hand, if they are to detail the design of buildings to the extent needed for cost control, and by contractors on the other hand, if they are to organise effectively their supplies of material and labour, is too little appreciated; and in most cases a radical change in financing procedure is needed if sufficient time is to be made available.

Decision-Making Mechanisms

141. Recognition of the foregoing principles has led all teams to recommend the institution of new decision-making mechanisms. Each of these mechanisms is naturally closely linked with national administrative practices and therefore a detailed description of any of them whould be of little general interest. In all cases, however, as the foregoing paragraphs will have suggested, teams see the need for a research and development unit to assist educational policymakers by exploring the implications of the alternatives open to them, and to develop new architectural, technical and administrative solutions to new educational problems as they arise; and for a Programme Planning Unit responsible for co-ordinating school building interests, for preparing and keeping up to date development plans for school location and priorities, for selecting new projects to be started according to established priorities and the finance available, and for ensuring that such finance is properly allocated among the projects concerned. It is self-evident that such units will be ineffective unless they are directly linked both with each other and with whatever authority or authorities are responsible for the execution of a building programme. Even when such units exist, they too often work either in isolation or with links that are merely formal. The major problem for administration is to ensure that all units are interdependent one on the other

Other Resource Problems

142. Finance is not likely to be the sole constraint in school production. Every country has difficulties over manpower. Generally speaking, there is an abundance of unskilled labour. In Turkey there is such an abundance of it that taxation incentives are used to encourage the use of labour-intensive methods of production. This produces a curious paradox. Some districts have no indigenous materials or components suitable for school building, and as a consequence the importation of pre-fabricated components made in another region is the only practical solution. But pre-fabrication is usually regarded as essentially factory produced by capital-intensive methods, and the Turks are therefore faced with the problem of devising a system of prefabrication produced with as little aid from machines as possible. The Spanish team draw attention to a situation typical for all participating countries... "Between 1950 and 1965 the percentage of the working population in the primary sector (Agriculture) decreased from 48.8% to 33.4% of total working population. This is reflected in an over-supply of non-skilled labour in the construction industry, which is the economic activity absorbing the greatest proportion of agricultural unemployment." The Turkish report also, draws attention to the possibility that the skill situation may be worse than it appears. "Apart from the quantity, there is also the quality factor. Due to the shortage of skilled workers, common labourers, after working for one or two construction seasons as unskilled workers, declare themselves, and find jobs as, skilled workers. In 1963, out of 585,000 registered with the building workers federation, only 28,504 (4.7%) were graduates of a technical school."

Possibilities for Pre-fabrication

143. No team has had the time or resources to develop any technological solution to the problems posed by the shortage of skilled labour, although some have made a preliminary exploration of the possibilities offered by prefabrication. They have not found, howver, any virtues in that direction which so far hold great promise for school building, except perhaps for small one or two classroom schools, where with some modification, the few proprietary systems available may be applied.

Working in close liaison with the DEEB team in Yugoslavia, a team with similar objectives was set up independently by the Slovenia Republican Secretariat for Education and Culture under the leadership of Architect Milivoj Lapuh. Their report to a joint meeting of Republican Secretariats held in Zagreb in 1965 has already been quoted in paragraph 132 above. Of prefabrication the report has this to say : " At the time under consideration there prevailed the opinion, in some administrative bodies, that the solution of the problem was to be found in complete prefabrication. That is quite natural owing to strong propaganda based on the prefabricated schools built in Skopje and a prefabricated school built in Ljubljana (the school 'Miran Jarc'). By comparing the cost of the latter school with the costs of schools built at the same time by the traditional method, we were able to ascertain that the prefabricated school 'Miran Jarc' (which was completed in 7 months) was more expensive by 38%. That is why we gave up prefabricated building."

144. Experience in countries outside the DEEB project suggests that for the successful application of prefabrication to school building a number of conditions must be satisfied, among which three predominate. Capital for the required plant must obviously be available; the difficulty of meeting this condition is the major obstacle in the DEEB countries. Secondly, to justify the capital investment, manufacturers must have reasonable confidence not only that demand for their product is unlikely to fall below a certain minimum, but that it is likely to be sustained.Present school building policies do not encourage confidence in either respect, because the volume of investment in schools is not known far enough ahead, if indeed it is made publicly known at all. Thirdly, if the advantages offered by prefabrication are not to be thrown away, components must be delivered and the craftsmen and labour needed for their assembly must be available on site precisely when the sequence of erection requires them to be. In the DEEB countries (as indeed in many others which are industrially more highly developed) too few construction firms are big enough to possess, or to have any prospect of employing, the management skills needed to accomplish this far from easy task. The Spanish report, for example, states that out of nearly 34,000 construction firms in Spain 85.6% employed less than 25 persons.

145. Ultimately, however, there is little doubt that prefabricated methods of some kind will be needed for school-building to reach the desirable level of production, and a search for solutions appropriate to the circumstances of each country should be undertaken at the earliest possible moment. The most important first step to be taken is, no doubt, that of creating (and justifying) confidence in a continuing market which will be sustained always above a certain minimum level. For this reason great importance attaches to the recommendation that the volume of investment to be devoted annually to school construction should be stated as far as possible in advance.

Shortage of Professional and Sub-professional Skills

146. Not surprisingly, all participating countries are gravely handicapped by a shortage of architects, engineers and their sub-professional equivalents. This is why so many of their schools are built to a uniform or standard plan. All teams draw attention to the weakness of this practice. Except on perfectly flat sites each school is bound to depart from the uniform design in respect of the necessary underbuilding which, precisely because of the uniformity, may often be wasteful of money and manpower.* Secondly, the details of construction specified may demand the use of materials or methods unobtainable or unsuitable in the locality where the school is built, leading either to unavoidable extravagance or else to major modifications in situ, which are not only expensive but re-impose on professional or sub-professional manpower a work-load no less than that which the uniform plan was meant to save. Thirdly, since these modifications must be made in situ, the need for them tends to become apparent only after building work has commenced, with consequent disruption of progress. Fourthly, uniform plans inhibit the introduction of improvements suggested by experience of schools in use.

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* In most of the Netherlands and part of Belgium standard plans are used without difficulty because the terrain is almost invariably flat and because the smallness of the countries and their highly developed transport systems mean that materials and constructions methods are no longer localised.

147. The teams agree that professional manpower can be better conserved, not by standard plans, but by adoption of a range of standard constructional details and components. The Slovene report already referred to describes achievements in this direction which are so remarkable that they must speak for themselves:

> "Analyses of cost and time in complete prefabrication disclosed the following percentages:
>
> | | | |
> |---|---|---|
> | 1. | foundations and all works below ground level | 20% |
> | 2. | erection of basic structures | 30% |
> | 3. | erection of final components | 50% |
>
> The greatest savings in time and money may be achieved with the standardisation of the final components (facing, carpentry, partition walls, etc.) Furthermore, it is known that the percentage of the finishings on the building amounts to 47% (painting works alone account for 23%). On the basis of these assumptions, we have adopted (for the organised school building action) the advanced traditional method for foundations and basic structures, the standardisation of industrially manufactured final components and the greatest possible reduction of finishings on the building. This way we have achieved, in comparison with the hitherto applied traditional method, a cost reduction of 22% (from 110,000 to 85,000 dinars) per sq. m. and reduced the time of erection to 8 effective months (as appears from the bill of quantities and from the contract with manufacturers). The idea of forming a central bureau, specialised for the designing of school buildings, was abandoned. With the consent of the communes concerned, whose interest and will to join our efforts in organised school building we were able to arouse, we invited selected designing organisations to cooperate with us. The communes then ordered from these organisations the necessary design drawings, specifications, bills of quantities, etc. The designers were obliged to keep to the general criteria worked out by our team, including the standardised final components, the designs of which were worked out by individual manufacturers in accordance with our requests and proposals. In the selection of material and structure the designers had to consider the technological process of building construction currently applied by the contractors and the application of locally available materials.

> The contract documents had to include, among others, the schedule of erection and the statement of the contractor specifying his readiness to deliver the completed school building by the scheduled date."

148. There is little doubt that activity of this kind apart from its evident intrinsic value, is a necessary initial step on any road which may eventually be taken towards full prefabrication. Likewise it will serve as a basis for the bulk purchase of building materials and components which the teams are also unanimous in advocating as a means towards further economies.

Need for a Decision-Making Continuum

149. One major implementation requirement is implicit in the teams' proposals, the full significance of which seems to have passed unnoticed. This is the need for continuity of responsibility for every constructional detail of a school from the time when the plans for it are first drawn up to the moment it is completed.

150. Here something must be said of how teams visualise that the cost of individual schools can be kept below the maximum proposed. They believe this can be assured by architects adopting the techniques of expenditure control described in School Building Resources Chapter XI. These techniques involve the use of two devices each complementing the other: an expenditure plan and subsequent cost checks. The expenditure plan, as its name implies, is a statement of how it is planned to distribute the total estimated expenditure among the constituent elements of the building. Cost checks are checks undertaken in the course of the detailed design to ensure that the estimated cost of the element as designed is in conformity with the expenditure plan. If the cost check reveals that it does not so conform the element concerned has to be re-considered. Proper application of these techniques demands accurate cost data on which to base the checks, and until a body of reliable data is built up too much should not be expected of them. Subject to this proviso, however, their application ensures, not only that the cost of the school will fall within the pre-determined limit of expenditure, but also that the full financial commitment needed for completion of the building is known before the commitment is entered into.

151. Clearly, under this system, every detail of what has to be built must be decided beforehand and covered by the expenditure plan and cost checks. Yet in many instances present practice leaves important decisions effecting final cost to be taken after construction has commenced, and taken, furthermore, not by the architects or engineers responsible for the plans, but by the builder or by some local supervisor of works, neither of whom has been associated with the decisions taken earlier. The usual consequence is that the final cost of the school exceeds, sometimes substantially, the estimate of the finance needed, so that the whole investment programme gets out of control, and in extreme cases building is halted until such time as the extra finance can be raised.

152. In such cases a change of practice is urgently needed. Where architects are at present expected to provide only large-scale drawings and an outline specification they will need in future to provide information to the builder in much greater detail. Where at the moment their responsibility ends when building work begins, it should in future extend to checking that the building is carried out according to the pre-determined details. This means their fees will have to be increased to pay for the extra services required, but the increase will be only a fraction of the overall savings likely to ensue, not only from improved control of building operations, but also from the longer-term benefits gained in information fed-back from production to design. In some cases, one section of a ministry may have responsability for architectural design, another for engineering services, a third for execution. Here steps will be needed to ensure that each section is equally cognisant of the expenditure plan and its significance, and equally responsible when making decisions for checking that it is adhered to. Similar considerations apply where a central organisation is responsible for design and local units for placing and supervising contracts. Here a Greek proposal is again worth noting:

> " The implementation of a programme of this magnitude would fail unless placed under constant, detailed and diligent supervision. A favourable factor in this respect is the proposed standardisation of building elements and their industrial manufacture, which would prevent attention being diverted to relatively unimportant details and would thus reduce the time required for

supervision. The supervision of projects should be organised on a regional basis by setting up supervisory services in the various districts and providing them with adequately qualified staff and equipment."

Training Requirements

153. Such proposals may appear only to place even more work on to professional manpower which is already overloaded. However, much of the work required can be entrusted to sub-professional grades who can be trained comparatively quickly for the task in hand. Their training should not only acquaint them with expenditure control techniques but should enable them to distinguish between decisions or actions which are clearly consistent with pre-determined expenditure plans and those on which a prior cost check is needed. Most important of all, however, they need to form a link in a continuous chain of responsibility leading directly from (and back to) the architects who have drawn up the expenditure plan and taken the major decisions in conformity with it.

International co-operation

154. This review of implementation problems in the DEEB countries would be incomplete without some reference to the implications of the project for international co-operation not only in respect of countries participating in the project but as it concerns other countries as well.

155. As with the Mediterranean Regional Project, each country has found encouragement in seeking appropriate solutions to its own problems from participating in a project which has revealed those problems as common, at least in principle, to all participants, which has consequently stimulated methodological discussion of common topics, and which has afforded access to expertise available elsewhere. In addition, it has provided valuable experience of the role technical assistance can play in effective international co-operation.

156. Among all the problems still unsolved and even unexplored in the DEEB countries, two overtop the rest: shortage of capital and shortage of skilled professionnal or constructional manpower.

The limited technical assistance provided under this project has helped the national teams to see more clearly the nature of their countries' school building problems and the steps needed to solve them. But much more than this is needed if the necessary steps are to be taken and taken quickly enough in a field so vast. In the DEEB countries it is not so much a question of teaching men how to fish as of helping to haul in the nets. Thus, to be effective, technical assistance must be substantial.

157. Secondly, the work of the teams has combined with the Secretariat's own studies to show beyond doubt that school building is not primarily a technological problem, but a complex of problems, which a matching complex of technological, educational and management skills are needed to solve. For technical assistance to be effective it needs to supply, not one expert here and another there, but a balanced team of inter-complementary experts integrated into a similar team of nationals. Furthermore, the nature of the problems is so embedded in the matrix of national culture, traditions and practices that foreigners, however expert they may be in their particular specialities, can gain little insight and make only a superficial contribution in the course of brief visits. Effective technical assistance needs to be not only substantial but prolonged. Professional teams need to work full-time in the country concerned, for at least a two or three year period, preferably after preliminary training to suit them for their task.

158. However, men are no good without money. For this reason early consideration should be given to how financial assistance and technical assistance can be treated together, so that one supports the other and both are rendered more effective. Some form of pilot scheme directed towards this end would be the best means of consolidating the results of the DEEB project and building on them for the future. Nevertheless, it must be emphasised that the success of such a scheme would depend on the degree to which the country concerned had already set up institutional arrangements of the kind recommended in the team reports and referred to generally in this chapter. Establishment of the appropriate mechanisms, especially the mechanisms needed to continue the work started by the DEEB project, is the most urgent condition to be fulfilled if the school building needs of the participating countries are to be met.

159. As this report will perhaps have indicated, the problems faced by the DEEB participants represent only an acute form of problems which, in principle, are likely to be encountered by any country expanding and developing its educational system: the basic conflict between aspirations and resources, the need to consider school provision and educational policy as inter-dependent, the need for agreed standards based firmly on current educational practice and adaptable to educational, social economic and technical change, the need too ensure the fullest value for expenditure by avoiding wasteful underutilisation, the need for cost analysis and control to ensure that planned expenditure produces the planned return, and the need for appropriate professional and institutional innovations. Thus the DEEB project may be seen as, in effect, a prototype for further international co-operation which could usefully extend beyond the confines of the participating countries and prove of benefit to other areas of the world as well.

CHAPTER V: SUMMARY

Origins

160. The project originated from an awareness, created by the Mediterranean Regional Project and by the International School Building Conference of 1962, that the speed and effectiveness of educational expansion in M.R.P. countries would be largely dependent on the development of suitable and economic school building facilities. (paras. 1 to 3)

Objectives

161. The objectives of the project, broadly speaking, have been to seek satisfactory solutions to the financial, functional, technological and administrative problems raised by school building in the light of the effective and economic implementation of the national school building expansion requirements.(paras. 4 to 7).

National Teams

162. For the implementation of the project, the Organisation sponsored the formation of teams, consisting solely of nationals of the countries participating, Greece, Spain, Portugal, Turkey and Yugoslavia. (paras.9 to 12). The duration of the project was limited to two years. (paras. 13 to 15).

Working Methods

163. An essential feature of the project was that suitable working methods had to be developed by the teams in consultation with OECD advisers as the project progressed. Thus the project has had value a field laboratory, generating research and testing hypotheses. (paras. 17 to 20). As a result teams have had to develop new skills, new attitudes and new habits of mind both in themselves and in others with whom the project brought them in contact. (paras. 21 to 24).

Range of Studies

164. With the resources of time and manpower available teams were unable to cover all aspects of school building. Higher education was specifically excluded and below the level of university entry teams

concentrated almost entirely on general education, the Greek, Portuguese and Turkish teams on both primary and secondary, the Spanish team on secondary only, and the Yugoslav team on elementary schools. (paras. 25 to 30).
Not the least striking feature of the project is the light it has cast on educational conditions as a whole. (paras. 31 to 33).

Standards

165. All teams recognise that no building is viable as a school unless it provides sufficient space, warmth, lighting, ventilation, furniture and equipment to enable teachers and pupils properly to perform their tasks. They have found in each of their countries that there are wide disparities in the standard of working conditions which are actually provided, especially in the amount of floor area usable for educational activity, and even more in the amounts of gross floor area within which educational activity area is contained. These disparities reflect unsatisfactory control over resource utilisation. (paras. 36 to 43).
166. The teams have accordingly made recommendations as to the minimum standards of floor area etc. which can be deemed to provide acceptable working conditions for different types and level of educational activity. As a corollary they have made similar recommendations as to the site areas required.(paras.44 to 61).
167. The minimum floor area recommended for each type, level and size of school (size being reckoned in terms of the maximum number of pupils enrolled) is based on the number of teaching rooms required and on the area which each room needs to be to allow a class of the usual size to perform the activity for which the room is intended. (paras. 49 to 56).
168. Study of educational requirements shows that in many cases the floor area of existing rooms needs to be increased; but a methodology developed and applied in the course of the project has shown that the number of rooms needed for a school of stated capacity is lower than is normally provided. As a result the teams have shown how improved working conditions may be obtained with reduced overall provision of floor area.(paras. 57 to 61).

169. The studies of standards demonstrate that they can not be considered in isolation from educational policy. Conversely, when educational policy is seen in the light of its effect on school building, strong grounds may emerge for reconsidering or modifying it. (paras. 62 to 70).

170. Partly because of limited time, partly because prior policy decisions are awaited in certain sectors, the teams have not been able to cover the whole range of institutions within the educational system of their countries, and they have been obliged to leave many avenues of inquiry unexplored. These include possiblities for the dual or multiple use of specialised teaching rooms, (paras. 77 to 79) and the intensified utilisation of school premises. (paras. 73 to 76, 80 to 81).

171. From the study of standards a number of new methodological approaches have emerged. One of these concerns the possibibility of overlapping shifts in the course of an extended school day. Adoption of this device could not only result in considerable economies but also ease difficulties arising from migration from rural to urban localities. (paras. 73 to 76). But the study has also revealed the need for further methodological refinement. This is likely to be of interest and value to countries which have not themselves participated in the project, both in the prospects it holds of economies from intensive utilisation and because of the attention it demands to the implications of educational innovation. (paras. 82 to 87).

Costs

172. All teams have shown that the working conditions represented by the minima recommended can be obtained at costs proportionally well below those at present incurred. This can be done by :

a) reducing the number of teaching rooms provided for a given curriculum and number of enrolled pupils (paras. 57 to 61).

b) reducing the amount of ancillary floor area provided for activities serving no real educational purpose. (paras. 97 to 99).

c) employing techniques of expenditure planning based on analysed constuctional costs. (paras. 101 to 104).

173. In the light of the foregoing, teams have, in most cases recommended the maximum limits of expenditure which they believe need not be exceeded in providing minimum working conditions appropriate to the type of school in question. (paras. 105 to 107).

174. The application of such limits of expenditure is rendered possible by the definition of the standards to be met. Wide variations in cost which have hitherto been attributed to differences in market conditions have been shown to be more the result of disparity in standards. (paras. 100 to 104). But the limitation of expenditure demands changes of practice which are dealt with below under the heading of Implementation.

175. Limitation in expenditure on each project places heavy responsibility on the architects of schools. This can only be properly discharged if adequate cost accounting procedures are introduced, (paras. 90 to 94) and these need to be accompanied by a reliable index of building or tender costs.

176. Costs per pupil vary, not only according to type of institution but according to enrolment capacity, and this in turn depends on the potential of the recruitment area which a school can be expected or planned to serve. This is a topic on which further study is needed. It brings architectural, educational, and geographical planning into a common focus. (paras. 108 to 112).

177. Costs per pupil have also been shown to vary according to the standard of working conditions provided, the accepted size of class, the extent to which items of accommodation are specialised or capable of multiple use, the range of curriculum choice, the length of school day and consequent school organisation, and the work or vacation pattern of the academic year. These parameters constitute a range of options among which policy-makers may choose in determining the balance between the desirable and the practical. (para. 114).

178. Total costs depend on the average cost per pupil and on the number of new pupil places to be provided. In all DEEB countries further calculation is needed to estimate the latter figure. So far, only the number of new entrants to the educational system seems to have been taken into account; but consideration is also needed of the effect of population movement, overcrowded and sub-standard premises, and the extra contribution obtainable from intensified use of the existing stock of schools. (paras. 117 to 122)

179. Present calculations of total costs should therefore be regarded as interim and are likely to prove an under-estimate; but even on present predictions, the savings which could accrue from acceptance of the teams' recommendations are likely to be dramatic. (para.123).

Implementation

180. In all countries a sharp acceleration is needed in school building production, but the obstacles to it, besides difficulties of finance, include shortages of professional manpower and craft skill. (paras. 125 to 126). Technical assistance from other countries, coupled with additional capital, is a continuing need in most cases. (para 156).

181. Changes are needed in existing professional practices to ensure continuity of professional responsibility from the time a school is planned to the moment of its completion, and to ensure full control over expenditure in respect of all constructional details. These changes may require new organisational mechanisms accompanied by suitable training of professional and sub-professional personnel. (paras. 149 to 153).

182. There is a sharp inter-action between school building and educational policy. Especially important are questions concerning the type of school to be provided in each case, the criteria governing recruitment area, the means to be adopted for intensifying utilisation, the employment and deployment of teachers, pupil/teacher ratio, and curriculum policy. (paras. 127 and 128).

183. In many countries decisions on educational policy questions of this kind are now required with extreme urgency if school building is not to suffer damaging delays. (para. 128).

184. The preparation of location and priority plans is a further urgent requirement, showing where schools of each type are needed, what recruitment area they are to serve and the order in which they are to be constructed. In preparing them, account is needed of how many usable places are available in existing schools assuming intensification of use that may be possible as the result of adaption or extension. (paras. 120, and 129 to 131).

185. In determining the number and size of projects to be undertaken over a given period the most important criterion is that no project should be started unless the finance needed for its completion, furnishing, equipment and subsequent maintenance is assured. (paras. 136 to 140).

186. To avoid under-use in the early life of a school and to ensure that resources are deployed where they are most urgently needed consideration should be given to construction in instalments of a size suitable for the immediate recruitment needs. (para. 132).

187. Conservation of skilled manpower leads many countries to use repeat or standard plans for individual building projects, but the benefits resulting are largely illusory. A preferable device is the adoption of standard constructional details and components, and striking financial economies are also reported where this device has been used. (para. 147).

188. A promise for further economies lies in the use of standard components if arrangements are made for their bulk purchase. (para.148).

189. The prefabrication of schools is, in most cases, a requirement whose urgency can be foreseen but which is not yet paramount. In the meantime, steps should be taken to provide the conditions in which prefabrication can flourish and in which manufacturers can have confidence in a continuing market demand of sufficient size. (paras.143 to 145).

190. Recommendations of national teams have not been able to cover the whole field of investigation with the time and resources available and need therefore to be treated as interim recommendations. There is an established need for further research and development which will concentrate primarily on increased production (para.125), on intensive utilisation (paras. 71 to 81) and the needs of educational innovation (paras. 84 to 87) and on the improvement of resource allocation and use resulting effectively in cost reductions. Much of the research and development needed is of equal interest to countries which have not so far participated in the project. This suggests scope for further international co-operation. (paras. 86 and 159).

191. The project confirms that the research and development needed is not primarily of a technological nature, but a complex requiring an inter-disciplinary approach of co-ordinated technological, educational and managements skills. (paras. 9 to 12). The continued operation of an inter-disciplinary team, strengthened where necessary, is essential to the rapid and economic implementation of future school building in all participating countries.

192. In addition DEEB countries require large-scale technical assistance, but to be effective, this needs to be provided in the form of co-ordinated inter-disciplinary professional personnel, trained for the task and integrated with national teams. (paras. 156 to 158).

193. In all team reports frequent reference is made to the need for co-ordination of school building activity, (i.e.) co-ordination of responsible central or local authorities, co-ordination of public and private sectors, of requirements and provisions made to meet them, and co-ordination between design and production, (paras 133 to 135). They emphasise equally the need for location and priority planning and for systematic advance resource allocation to individual projects, (paras. 129 to 131 and 140). Suitable institutional arrangements, especially for the continuation of research and development, are an urgent and essential pre-requisite of performing these tasks. The success of future technical co-operation will depend on the extent to which such arrangements have been made. (para. 158).

194. The problems encountered in the course of the project are simply an acute form of those common to all countries expanding and developing their educational systems. Thus the DEEB project may be seen as a prototype for extending co-operation in school building topics to a wider international field. (para. 159).

STATISTICAL ANNEX

Table 1(a)

Area Analyses of typical existing schools

GREECE

	Teaching area sq.m. per pupil	Total area sq.m. per pupil	Teaching area as percentage of total
Primary schools			
School (a)	1.9	7.6	25%
(b)	1.9	6.0	32%
(c)	1.3	3.1	42%
(d)	1.7	3.0	57%
Secondary schools			
School (a)	2.1	8.4	25%
(b)	1.6	4.8	33%

Table 1(b)

Area analyses of typical existing schools

PORTUGAL

	Teaching area sq.m. per pupil	Total area sq.m. per pupil	Teaching area as percentage of total
Primary schools			
School (a)	1.31	4.87	27%
(b)	1.28	3.54	36%
(c)	1.25	2.83	44%
Liceus			
School (a)	1.61	4.98	32%
(b)	2.09	5.32	39%
(c)	2.10	4.91	43%
(d)	2.37	3.85	61%

1 *(a)* cont'd **Greece**

Portugal 1 *(b)* cont'd

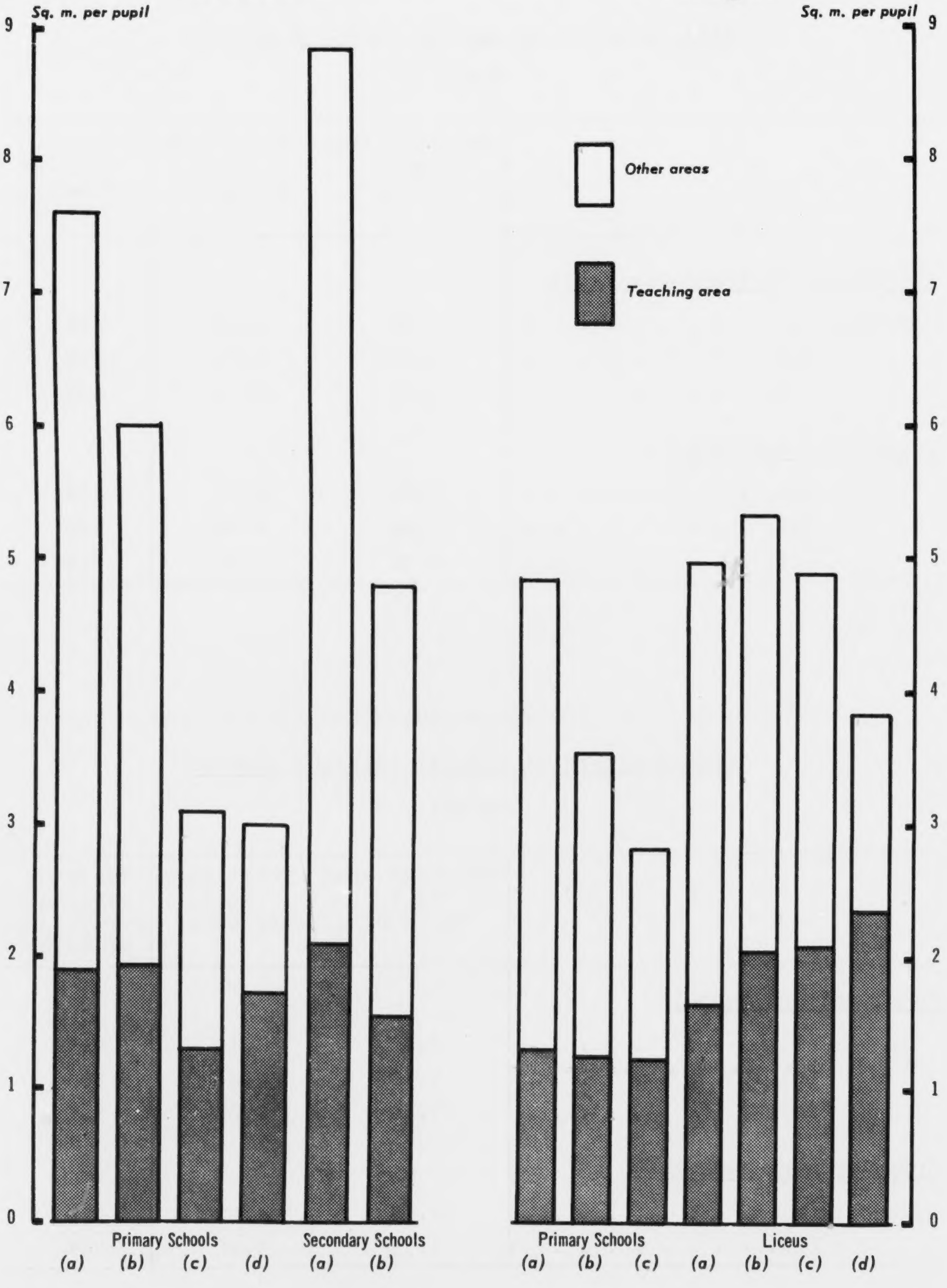


Table 1(c)

Area analyses of typical existing schools

SPAIN

	Teaching area sq.m. per pupil	Total area sq.m. per pupil	Teaching area as percentage of total
Institutos de Enseñanza Media			
School (a)	1.86	4.46	42%
(b)	1.88	3.85	49%
(c)	3.95	7.21	55%
Institutos Laborales			
School (a)	7.89	19.10	41%
(b)	3.89	8.58	45%
(c)	4.56	7.50	61%

Table 1(d)

Area analyses of typical existing schools

TURKEY

	Teaching area sq.m. per pupil	Total area sq.m. per pupil	Teaching area as percentage of total
Rural primary schools			
School (a)	1.10	2.50	44%
(b)	1.10	2.21	50%
(c)	1.10	2.02	54%
Urban primary schools			
School (a)	1.48	4.00	37%
(b)	1.55	3.40	46%

1(c) cont'd

1(d) cont'd

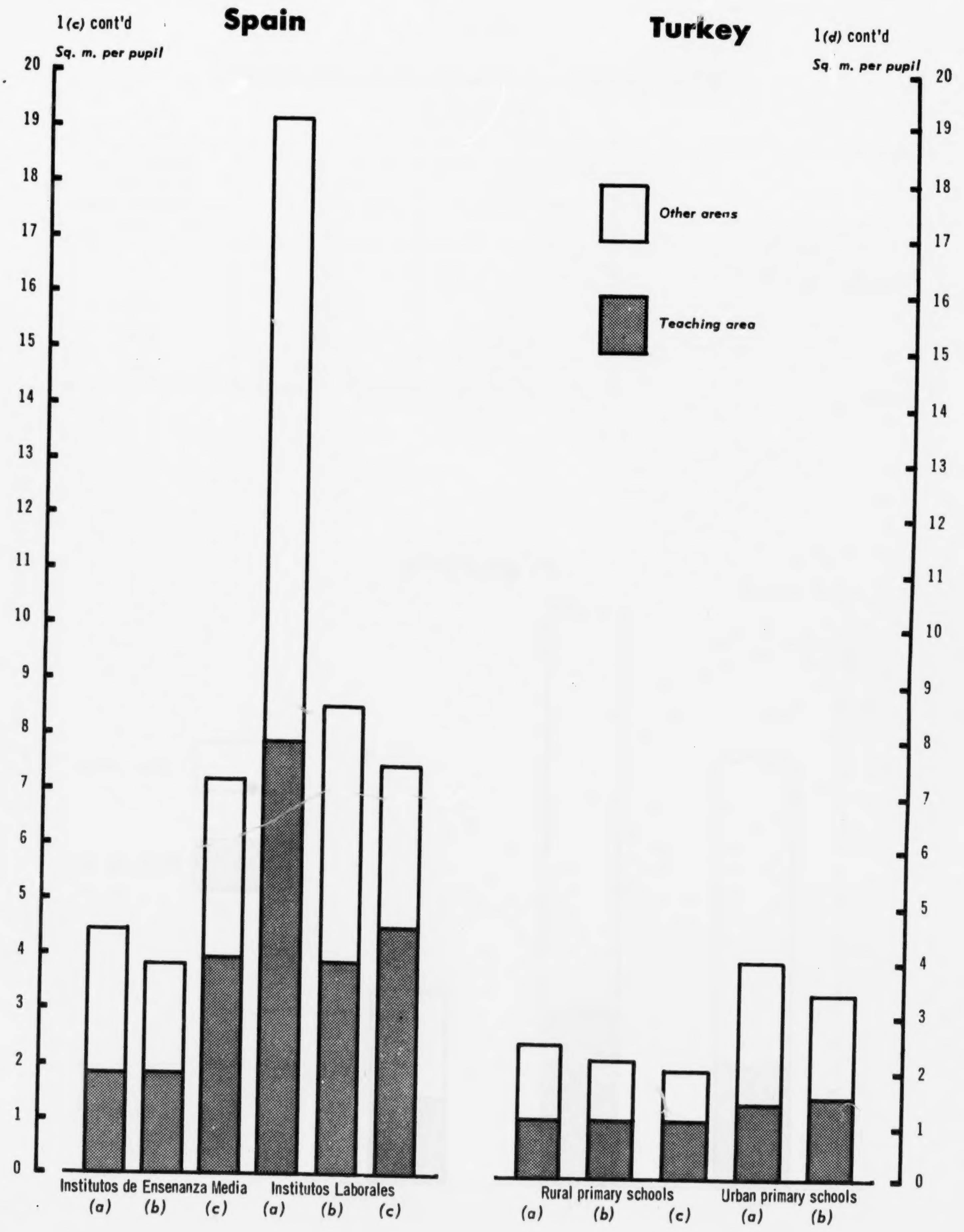


Table 1(e)

Area analysis of typical existing schools

YUGOSLAVIA

	Teaching area sq.m. per pupil	Total area sq.m. per pupil	Teaching area as percentage of total
Primary schools			
Schools (a)	2.50	8.79	28%
(b)	3.60	11.85	30%
(c)	1.77	3.98	44%

1(e) cont'd

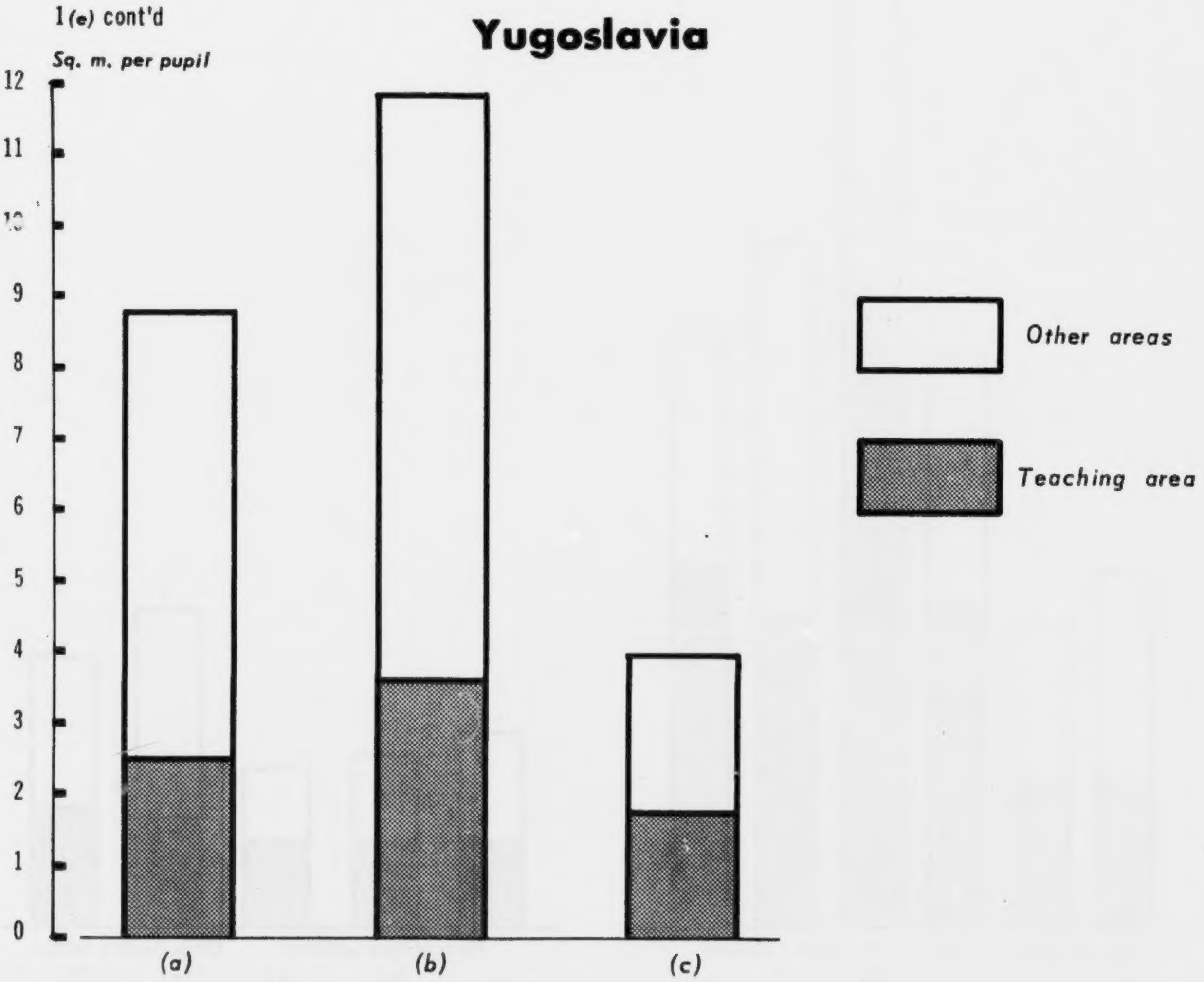


Table 2(a)

Teaching spaces - recommended minimum areas

GREECE

(Sq.m. per pupil)

	Primary classes of 40	Secondary classes of	
		20	40
General classrooms			
(a) Junior	1.5		
(b) Senior			1.6
Foreign languages	1.5		1.6
Science rooms/laboratories	2.125		2.0
Arts & crafts			
(a) Domestic science		2.3	
(b) Workshops			2.4
Drawing	2.25		
Music	1.63		
Gymnasium	4.5(+)		(+)

(+) Where numbers warrant it, a multipurpose hall is recommended on a scale of 0.6 sq.m. per pupil on roll.

Table 2(b)

Teaching spaces - Recommended minimum areas

PORTUGAL

(Sq.m. per pupil)

	Classes of				
	18/20	21/25	26/32	32/36	40
General classrooms					
(a) Junior					0.5
(b) Senior	1.9	1.8	1.7	1.6	
Foreign languages	1.9	1.8	1.7	1.6	
Science rooms/laboratories	2.0	1.9	1.8	1.7	
Arts & crafts					
(a) Domestic science	3.8	3.7	3.6	3.5	
(b) Workshops	3.5	3.4	3.2	3.1	
Drawing	2.5	2.4	2.3	2.2	
Music		1.9	1.8	1.7	
Gymnasium				5.5	

Table 2(c)

Teaching spaces - recommended minimum areas

SPAIN

(Sq.m. per pupil)

	Classes of					
	10	20	25	30	40	80
General classrooms						
(a) Junior.						
(b) Senior.			1.4		1.4	
Foreign languages				2.0		
Science rooms/laboratories. . .					2.0	
Arts and crafts						
(a) Domestic science.					2.0	
(b) Workshops	3.5	3.0			2.8	2.6
Drawing					2.5	
Music						
Gymnasium					2.0(*)	

(*) For gymnasium purposes alone, 2 sq. m. per pupil is recommended, but where circumstances warrant, a dual purpose gymnasium/hall of 200 sq.m. is recommended.

Table 2(d)

Teaching spaces - Recommended minimum areas

TURKEY

(Sq.m. per pupil)

	class of 40
General classrooms	
(a) Primary schools	1.1

Notes: The DEEB team in Turkey has only proposed standards of area for primary schools so far. It envisages that further studies will make it possible to formulate the standards of area for other stages of education. It suggests that the minimum be extended to 1.2 sq.m. per pupil (the maximum standard) for urban primary schools where overcrowding is more important.

Table 2(e)

Teaching spaces - recommended minimum areas

YUGOSLAVIA

(Sq.m. per pupil)

	Classes of	
	18	36
General classrooms		
(a) junior		1.7
(b) senior		1.5
Foreign languages	1.1	
Science rooms/laboratories		1.86
Arts & crafts		
(a) Domestic science	1.5	
(b) Workshops	3.2	
Drawing		
Music		
Gymnasium		8
Laboratory/Workshop		
(a) used for science		2.3
(b) used for technical education	4.6	

Table 3(a)

Curriculum load effect in 22 class school

Curriculum Subjects (i)	Hours per subject (ii)	Load from 22 classes (iii)	Load capacity (iv)	Required spaces (v)	Area sq.m. (vi)
Mother tongue, History & Geography, Morals & Religion	10	220	7.85	8 general purpose class-rooms	435.2
Modern languages	3	66	2.35	3 language class-rooms	163.2
Science	3	66	2.35	3 science laboratories	171.6
Mathematics	3	66	2.35	3 mathematics rooms	163.2
Physical Education	2	44	1.57	2 gymnasia	400.0
Music	2	44	1.57	2 music rooms	114.4
Drawing	3	66	2.35	3 drawing studios	220.8
Craft work	2	44	1.57	2 craft workshops	220.0
Total period of simultaneous attendance	28	Total number of teaching spaces (for 22 classes). . 26		Total area	2,088.4
				Area per class . . .	95.0

Table 3(b)

22 class school, but with 33 hours of simultaneous weekly attendance

Curriculum Subjects (i)	Hours per Subject (ii)	Load from 22 classes (iii)	Load capacity (iv)	Required spaces (v)	Area sq.m (vi)
Extra-curricular hours of attendance	5)				
Mother tongue, History & Geography, Morals & Religion	) 10)15	330	10.0	10 general purpose class-rooms	544.0
Modern languages	3	66	2.0	2 language class-rooms	108.8
Science	3	66	2.0	2 science laboratories	114.4
Mathematics.	3	66	2.0	2 mathematics rooms	104.8
Physical Education	2	44	1.33	2 gymnasia	400.0
Music	2	44	1.33	2 music rooms	114.4
Drawing	3	66	2.0	2 drawing studios	147.2
Craft work	2	44	1.33	2 craft workshops	220.0
Total period of simultaneous attendance	33	Total number of teaching spaces (for 22 classes) . . 24		Total area . . . . . . Area per class	1.753.6 79.7

Table 3(c)

12 class school with 36 hours period of simultaneous attendance

Curriculum Subjects (i)	Hours per Subject (ii)	load from 12 classes (iii)	Spaces required (load/36 to nearest higher integer) (iv)	Floor area sq.m (v)
Extra-curricular hours of attendance	8			
Mother tongue, History & Geography, Morals & Religion	10	216	6 general purpose class-rooms	326.40
Modern languages	3	36	1 language room	54.40
Science	3	36	1 laboratory	57.20
Mathematics	3	36	1 mathematics room	54.40
Physical Education	2	24	1 gymnasium	200.00
Music	2	24	1 music room	57.20
Drawing	3	36	1 drawing studio	73.60
Craft work	2	24	1 Craft workshop	110.00
Total hours of simultaneous attendance	36		13 spaces for 12 classes	
			Totalling	933.20
			and averaging	77.80 (per class)

Table 3(d)

8 class school with 28 hours simultaneous attendance

Curriculum Subjects (i)	Hours per Subject (ii)	Load from 8 classes (iii)	Spaces required (load/28 to nearest higher integer) (iv)	floor area sq.m (v)
Mother tongue, History & Geography, Morals & Religion	10	80	3 general purpose class-room	162.20
Modern languages	3	24	1 language room	54.40
Science	3	24	1 laboratory	57.20
Mathematics	3	24	1 mathematics room	54.40
Physical Education	2	16	1 gymnasium	200.00
Music	2	16	1 music room	57.20
Drawing	3	24	1 drawing studio	73.60
Craft work	2	16	1 Craft work shop	110.00
Total hours of simultaneous attendance	28		10 spaces for 8 classes Totalling and averaging	769.00 96.13 (per class)

Table 4(a)

Recommended minimum and maximum areas and consequent costs per pupil

GREECE

No. of pupils	Minimum teaching area per pupil sq.m	National gross area per pupil sq.m	Cost per pupil drachmae
Primary schools			
240	2.35	3.93	9,194
360	2.30	3.90	9,079
480	2.37	3.82	8,816
Secondary schools (Gymnasia)			
120	1.88	3.57	8,733
240	2.98	5.40	12,665
360	2.34	4.16	9,592
480	2.91	4.85	11,159
720	2.43	3.95	8,914

Notes: Greece has analysed curricula and timetables and applied the proposed standards of area to prepare schedules of accommodation for various sizes of school. A typical selection of these is given above.

Table 4(b)

Recommended minimum and maximum areas and consequent costs per pupil.

PORTUGAL

No. of pupils	Minimum teaching area per pupil sq.m	National gross area per pupil sq.m	Cost per pupil escudos	Cost place adjustment
Primary schools				
160	2.0	3.45	3,450	+5
240	2.0	3.40	3,400	0
320	2.0	3.30	3,330	-5
400	2.0	3.28	3,280	-10
480	2.0	3.23	3,230	-20

Notes: Analysis of the needs of schools of different sizes shows that no single area per pupil or cost per pupil is universally valid. Portugal recommends a system of "equivalent places" (see "School Building Resources and their Effective use", Chapter 3.), and this makes it possible to use a standard figure of 3,400 escudos per equivalent place for primary schools of different sizes. Similar tables have been established for "observation cycle" schools.

The final column "cost place adjustment" shows how the number of equivalent places is calculated for a school of a given size. For example a primary school for 400 pupils would be entitled to 400 -10 i.e. 390 equivalent places at the standard rate of 3,400 escudos per equivalent place.

Table 4(c)

Recommended minimum and maximum areas and consequent costs per pupil

SPAIN

No. of pupils	Minimum teaching area per pupil sq.m	Maximum total area per pupil sq.m	Cost per pupil pesetas
Secciones Delegadas			
400	2.0	4.0	12,600
640	1.67	3.1	10,000
Institutos de Ensenanza Media			
640	2.3	4.2	13,200
1,000	2.0	3.6	11,300
Institutos Laborales			
480 (no workshops) . . .	1.7	3.5	10,500
480 (workshops)	2.6	4.8	15,200

Notes: Spain has analysed the minimum teaching area required in schools of different sizes and types, used this minimum to establish a maximum total area for each category, and then applied a standard rate per sq.m to establish the cost limit for each project. As a result the cost per pupil varies not only with the type of establishment, but also with its size.

Table 4(d)

Recommended minimum and maximum areas and consequent costs per pupil

TURKEY

No. of pupils	Minimum teaching area per pupil sq.m	National gross area per pupil sq.m	Cost per pupil T.Lire
Rural primary schools			
Type I : 40	1.10	1.90	1120
80	1.10	1.56	990
120	1.10	1.45	948
Type II : 120	1.10	1.93	1125
Type III: 40	1.10	2.03	1197
80	1.10	1.74	1057
120	1.10	1.68	1030
Urban primary schools			
Type I : 200	1.48	2.87	800
400	1.55	2.73	757
Type II : 200	1.48	2.83	791
400	1.55	2.68	748

Notes : The minimum teaching areas and the national gross areas shown for Turkey are taken from the DEEB teams tentative designs. These are not primarily intended for implementation; their purpose is to show the applicability of the area standards proposed and the amount of economy that can be achieved in both areas and cost.

Table 4(e)

Recommended minimum and maximum are[illegible] and consequent costs per pupil

YUGOSLAV[illegible]

Grades I - IV	Senior grades	No. of pupils	Minimum compulsory area per pupil sq.m	Maximum gross area per pupil sq.m	Cost per pupil thousand dinars
4 +	0	144	2.6	3.6	353
4 +	4	288	3.4	4.88	488
4 +	8	432	3.4	5.26	526
4 +	12	576	3.6	5.22	522
8 +	12	720	3.5	4.87	487
12 +	12	864	3.3	4.55	455

Notes : Grades I - IV are for ages 7 to 10 inclusive. Senior grades are for ages 11 to 14 and require specialised teaching facilities in addition to general classrooms.

Yugoslavia has analysed the requirements of different sizes and types of schools. The six examples quoted above have been chosen as typical from the wide range of sizes analysed. Such analyses are used to establish the minimum area of net compulsory spaces for each size and type of school. This is used to reach a maximum gross area for each size and type of school; and to the maximum gross area a uniform rate per sq.m is applied to reach the standardised cost.

The minimum compulsory area includes not only teaching area, but other accommodation such as a school kitchen, administrative accommodation etc. essential to the school.

Table 5(a)

Recommended standards for site area

GREECE

	No. of pupils	Minimum area per pupil sq.m.
Primary schools	40	27.5
	80	20.0
	120	17.7
	240	18.7
	360	17.7
	480	16.4
Secondary schools (Gymnasia)	120	15.0
	240	17.6
	360	15.2
	480	15.1
	720	13.6

Table 5(b)

Recommended standards for site area

PORTUGAL

	No. of pupils	Minimum area per pupil sq.m.
Primary schools	up to 48	25
	80	21
	120	18.75
	160	17.5
	240	16
	320	15.6
	400	15.25
	480	15
Observation cycle schools	up to 320	30
	321 to 640	25 per pupil over 320
	more than 641	20 per pupil over 640

Table 5(c)

Recommended standards for site area

SPAIN

	No.of pupils	Minimum area per pupil - sq.m.	
		Without workshops	With workshops
Secondary schools	400 to 500	15	18
	550 to 700	14	16
	750 to 1,000	13	14

Table 5(d)

Recommended standards for site area

TURKEY

	No. of pupils	Minimum area per pupil sq.m.
Primary schools	40	20
	80	17.5
	120	15
	200	11
	400	8.7

Table 5(e)

Recommended standards for site area

YUGOSLAVIA

	Minimum area per pupil sq.m.
Elementary schools of all grades	25

Table 6(a)

Cost per sq.m. in analysed schools

(net building costs at 1965 prices)

GREECE

Drachmae per sq.m.	Primary, Secondary and Lower Technical (see notes below)
2,800	x
2,600	x
2,400	
2,200	x
2,000	x
1,800	xxxxxx
1,600	xxx
1,400	xxxx
1,200	xxx
1,000	

Notes : These costs relate to 3 lower technical schools, 3 secondary schools in urban centres, 4 primary schools in urban centres and 7 primary schools in small towns. The DEEB team found a great dispersion in costs, which seemed to be related primarily to the differences in construction quality between urban centre and more rural schools. The cost per sq.m. at each school analysed has been plotted against the nearest entry in the frequency table. For example a school costing 1530 drachmae per sq.m. has been plotted as an entry against 1600 drachmae. The actual figures of a high, medium and low cost school are quoted in table 7 (a).

Table 6(b)

Cost per sq.m. in analysed schools

(net building costs at 1965 prices)

PORTUGAL

Escudos per sq.m.	Primary	Liceus	Elementary/ Technical
2,200			
2,100	x		
2,000			
1,900	x		
1,800	x		
1,700	x		
1,600	x		
1,500	xxxxx		x
1,400	xx	x	
1,300	x	x	xxx
1,200	xxxx	xxx	
1,100		xxxx	
1,000	xxxxxxxx	x	xx
900	xxx		
800	xxxx		
700			
600	x		

Table 6(c)

Cost per sq.m. in analysed schools

(net building costs at 1965 prices)

SPAIN

Pesetas per sq.m.	Institutos Laborales	Institutos de Ensenanza Media
3,200		x
3,000	x	xxxx
2,800	x	
2,600		
2,400	xx	x
2,200	x	
2,000	x	
1,800		

Table 6(d)

Cost per sq.m. in analysed schools

(net building costs at 1964 prices)

TURKEY

T.Lire per sq.m.	3 class primary schools (120 pupils)
500	x
475	
450	
425	
400	
375	xx
350	xxx
325	xxxxxx
300	xxxxx
275	xxxxxxx
250	xxxxx
225	xxxx
200	xxx
175	
150	x

Table 6(e)

Cost per sq.m. in analysed schools

(net building costs at 1965 prices)

YUGOSLAVIA

Dinars per sq.m.	Primary
160,000	x
150,000	
140,000	
130,000	
120,000	xx
110,000	xx
100,000	x
90,000	x
80,000	x
70,000	
60,000	x

Table 7(a)

Range of costs per sq. m.

(1965 prices)

GREECE

	Drachmae per sq.m.	Cost of 10 sq.m. as percentage of GNP/capita
Primary schools		
High cost	2828	160%
Medium cost	1530	86%
Low cost	1208	68%
Recommended cost	2000(*)	113%
Secondary and technical schools		
High cost	2196	124%
Medium cost	1788	101%
Low cost	1250	78%
Recommended cost	2000(*)	113%

(*)These recommended figures are for Athens and Thessaloniki. Greece concluded that construction costs per sq.m. are approximately the same for all types of school, but that there were significant variations in the cost of labour and materials in different locations. They have therefore compiled a location cost index with different weightings for Athens, major urban centres, plains, mountains and islands.

Table 7(b)

Range of costs per sq.m.

(1965 prices)

PORTUGAL

	Escudos per sq.m.	Cost of 10 sq.m. as percentage of GNP/capita
Primary schools		
High cost	2101	179%
Medium cost	1305	111%
Low cost	598	51%
Recommended cost	1000(+)	85%
Liceus		
High cost	1391	119%
Medium cost	1195	102%
Low cost	986	84%
Recommended cost	1200(*)	102%

(+)for schools with design numbers of 160 pupils and above.
(*)for observation cycle schools.

Table 7(c)

Range of costs per sq.m.
(1965 prices)

SPAIN

	Pesetas per sq.m.	Cost of 10 sq.m. as percentage of GNP/capita
Institutos de Enseñanza Media		
High cost	3,209	95%
Medium cost	2,959	88%
Low cost.	2,417	72%
Recommended cost.	3,300	98%
Institutos laborales		
High cost	3,008	89%
Medium cost	2,455	73%
Low cost.	1,998	59%
Recommended cost.	3,300	98%

Table 7(d)

Range of costs per sq.m.

(1964 prices)

TURKEY

	T. Lire per sq.m.	Cost of 10 sq.m. as percentage of GNP/capita
Primary schools		
High cost	496	212%
Medium cost	292	125%
Low cost.	146	62%
Recommended cost - rural.	368(*)	157%
- urban.	279(*)	119%

(*)The high, medium and low figures are taken from the building costs of three class primary schools used in table 6(d). The recommended costs are average estimates on a nationwide scale. Provincial variations are calculated by formulae with weightings for cost of materials, labour and transportation for each province of Turkey.

Table 7(e)

Range of costs per sq.m.

(1965 prices)

YUGOSLAVIA

	Dinars per sq.m.
Primary schools	
High cost	161,236
Medium cost	112,218
Low cost.	57,077
Recommended cost.	100,080

Table 8(a)

Existing and recommended costs per pupil

GREECE

	Cost per pupil drachmae (1965 prices)	Cost per pupil as percentage of GNP/capita
Secondary schools in urban centres		
High cost	10,469	59%
Medium cost	8,567	48%
Low cost	6,878	39%
Recommended cost(1)	8,425	47%
Primary schools in urban centres		
High cost	11,913	67%
Medium cost	10,027	56%
Low cost	4,620	26%
Recommended cost(2)	8,8I6	49%

Notes : From the schools analysed a typical high, medium and low cost per pupil has been selected to show the range of variation. For comparison, the cost per pupil recommended by the DEEB teams for a comparable school has been added.

In the proposed standards, schools of different sizes have different areas recommended and the consequent cost per pupil varies with the differing sizes of school.

(1) For lyceum of 720 pupils

(2) For an urban primary school of 480 pupils

Table 8(b)

Existing and recommended costs per pupil

PORTUGAL

	No. of pupils in school	Cost per pupil escudos (1965 prices)	Cost per pupil as percentage of GNP/capita
Primary schools			
High cost	480	7,488	64%
Medium cost	400	3,645	31%
Low cost	160	1,867	16%
Recommended cost .	240	3,500	30%
Liceus			
High cost	1,332	8,000	68%
Medium cost	1,368	6,005	51%
Low cost	2,124	4,154	35%
Recommended cost .	832	5,760	48%

Notes : The number of pupils is quoted to give an idea of the size of school. Size has some influence on cost per pupil (see Table 4), but it is not the major cause of the variations in cost per pupil observed.

Portugal has studied in detail the specific needs of a new type of secondary school - "the observation cycle". Recommended costs under 'liceus' are those prepared for this new category of school.

Recommended costs are based on the application of a standard cost per place to the calculated number of equivalent cost places (see Table 4(b))

Table 8(c)

Existing and recommended costs per pupil

SPAIN

	No. of pupils in school	Cost per pupil pesetas (1965 prices)	Cost per pupil as percentage of GNP/capita
Institutos de Enseñanza Media			
High cost	705	36,556	109%
Medium cost	2,000	21,894	65%
Low cost	1,630	13,789	41%
Recommended cost . .	1,000	11,300	34%
Institutos Laborales			
High cost	160	58,739	175%
Medium cost	364	28,686	85%
Low cost	400	16,055	48%
Recommended cost . .	480	15,200	45%

Notes : The number of pupils is that for which the school was designed. In Spain, some schools were found to be overcrowded, and others had fewer pupils on roll than their design capacity.
Recommended costs are based on the uniform rate per sq.m. for the recommended area calculated for the size and type of school.

Table 8(d)

Existing and recommended costs per pupil

TURKEY

	No. of pupils in school	Cost per pupil T. Lire (1964 prices)	Cost per pupil as percentage of GNP/capita
Primary schools			
High cost	120	1,961	84%
Medium cost	120	1,064	45%
Low cost	120	725	31%
Recommended cost .	120	833	35%

Notes : The number of pupils is that for which the school was designed i.e. 3 classes of 40 although in fact there are many more pupils per class than this in most Turkish schools. The cost includes WC s and teacher's residence. No recommended costs are given, but some examples of the way in which the team's tentative designs would reduce cost per pupil are given for the examples cited in Table 9(d). The entry here is taken from the 120 pupil rural school proposals.

Table 8(e)

Existing and recommended costs per pupil

YUGOSLAVIA

	No of pupils	Cost per pupil dinars (1965 prices)
Primary schools		
High cost	504	998,210
Medium cost	432	721,410
Low cost.	648	228,360
Recommended cost.		
(a) regional school	60	318,254
(b) central school	504	492,394

Notes: Recommended costs are based on a uniform rate per sq.m. for the agreed standardised area. The standardised area varies with schools of different type and different size [see Table 4(e)]

Table 9(a)

Examples of changes in cost with new cost limits

(at 1965 prices)

GREECE

Type of school	Actual cost per pupil drachmae	Recommended cost limit per pupil drachmae	Percentage difference
Primary school			
240 pupils	10,928	9,194	- 16%
480 pupils	11,913	8,816	- 26%

Notes: The actual cost per pupil is the cost at 1965 prices of two of the examples analysed. The recommended cost limit per pupil is the limit reached by applying the new recommendations.

Table 9(b)

Examples of changes in cost with new cost limits

(at 1965 prices)

PORTUGAL

Type of school	Actual cost per pupil escudos	Recommended cost limit per pupil escudos	Percentage difference
Primary school			
480 pupils	7,488	3,270	- 56%
400 pupils	3,645	3,412	- 9%

Table 9(c)

Examples of changes in cost with new cost limits

(at 1965 prices)

SPAIN

Type of school	Practical existing limits per pupil pesetas	Recommended cost limit per pupil pesetas	Percentage difference
Seccion Delegada (400 pupils) . .	12,450	12,600	+ 1.2%
Instituto de Enseñanza Media (1,000 pupils).	15,400	11,300	- 26%
Instituto Laboral (480 pupils). .	25,000	15,200	- 39%

Table 9(d)

Examples of changes in cost with new cost proposals

(at 1964 prices)

TURKEY

Type of School	Cost per pupil current designs T. Lire	Cost per pupil of team's tentative designs T. Lire	Percentage difference
Primary rural			
40 pupils	1,653	1,191	- 28%
80 pupils	1,386	952	- 31%
120 pupils	1,283	833	- 35%
Primary urban			
200 pupils	1,280	801	- 37%
400 pupils	1,102	760	- 31%

Table 9(e)

Examples of changes in cost with new cost limits

(at 1965 prices)

YUGOSLAVIA

Type of school	Actual cost per pupil thousand dinars	Recommended cost limit per pupil thousand dinars	Percentage difference
Primary school			
432 pupils	910	460	- 49%
504 pupils	999	492	- 50%
504 pupils	561	492	- 12%
Sample of seven primary schools	702	470	- 33%

Table 10(a)

Example of investment required for planned expansion of primary education and savings expected from recommendations

PORTUGAL

	Escudos (at 1965 prices)
7,000 new primary school places	
- At existing medium cost per pupil of 3,645 escudos	25,515,000
- At recommended cost per pupil of 3,500 escudos	24,500,000
Expected saving	1,015,000

Notes: The number of new places is based on the M.R.P.'s team estimate of requirements between 1968 and 1974 - that on minimum requirements it will be necessary to provide some 2,288 new and 4,712 replacement primary school places.

Table 10(b)

Examples of investment required for planned expansion at secondary level and savings expected from recommendations

SPAIN

	Million pesetas (at 1965 prices)
Ensenañza Media General	
1,286,500 new places	
- At existing practical cost per place of 15,000 pesetas	19,297.5
- At recommended cost per place of 11,300 pesetas	14,537.45
Expected saving	4,760
Institutos Laborales	
206,200 new places	
- At existing practical cost per place of 30,000 pesetas	6,186
- At recommended cost per place of 15,000 pesetas	3,093
Expected saving	3,093

Notes: The number of new places is based on the DEEB team's estimate of requirements 1966 to 1976. This is based on the M.R.P. team's estimate of places needed by 1974, and an assessment of additional places needed for this and to make good obsolescence.

Table 10(c)

Example of investment required for planned expansion of primary education and savings expected from recommendations

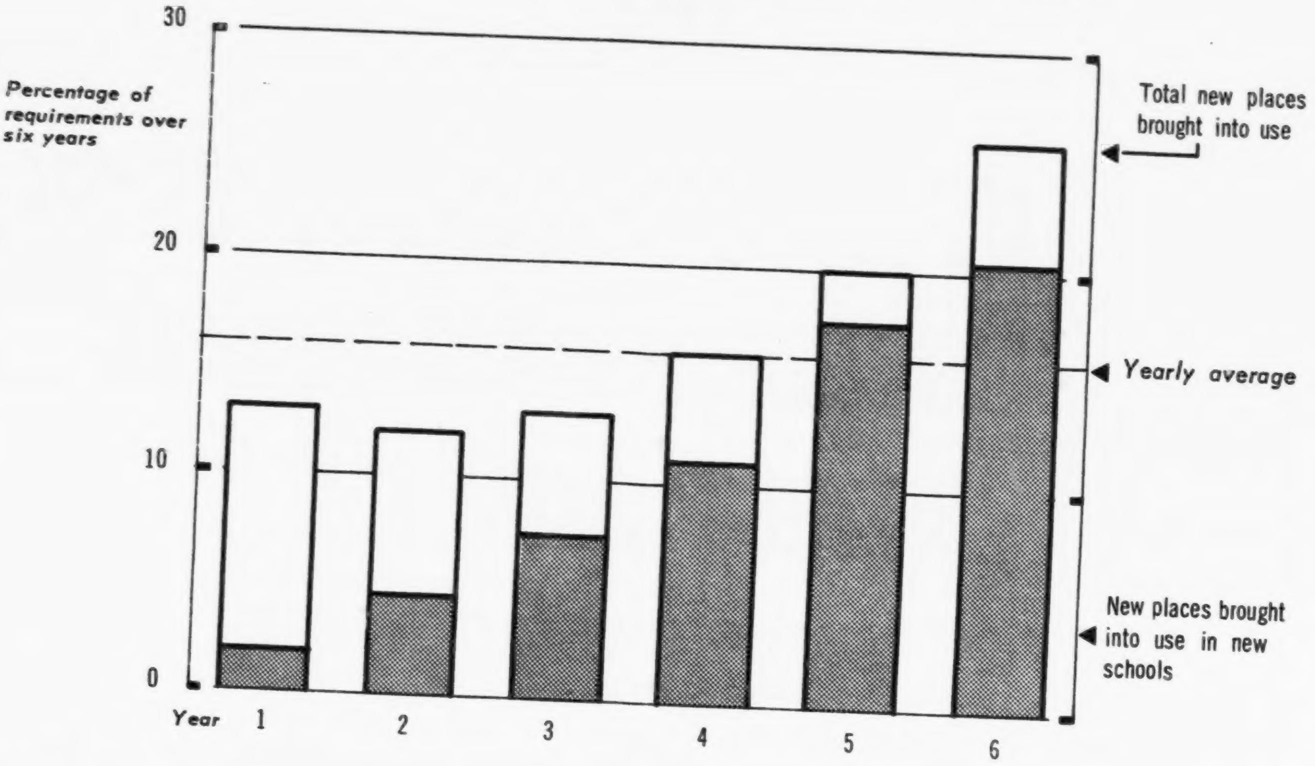
YUGOSLAVIA

	Million dinars (at 1965 prices)
324,710 new primary school places	
- At existing medium cost per place, of 721,410 dinars	234,249
- At recommended cost per place, say 500,000 dinars	162,355
Expected saving	71,894

Notes: The number of places needed is based on the calculation of needs 1963 to 1970 by a Yugoslav Government Commission:

	No. of places needed
(a) Additional pupils	
Pupils expected in 1970	3,086,864
Less Pupils in 1963	2,960,641
	126,223
To accommodate $\frac{2}{3}$ in two shifts and $\frac{1}{3}$ in one shift	84,148
(b) To eliminate three and four shifts in schools .	114,000
(c) To replace obsolescence 1.58% per annum, i.e. 632,811 sq.m. over 7 years, equivalent to	126,562
Total new places	324,710

Table 11. ACCELERATION REQUIRED IN SCHOOL BUILDING OUTPUT

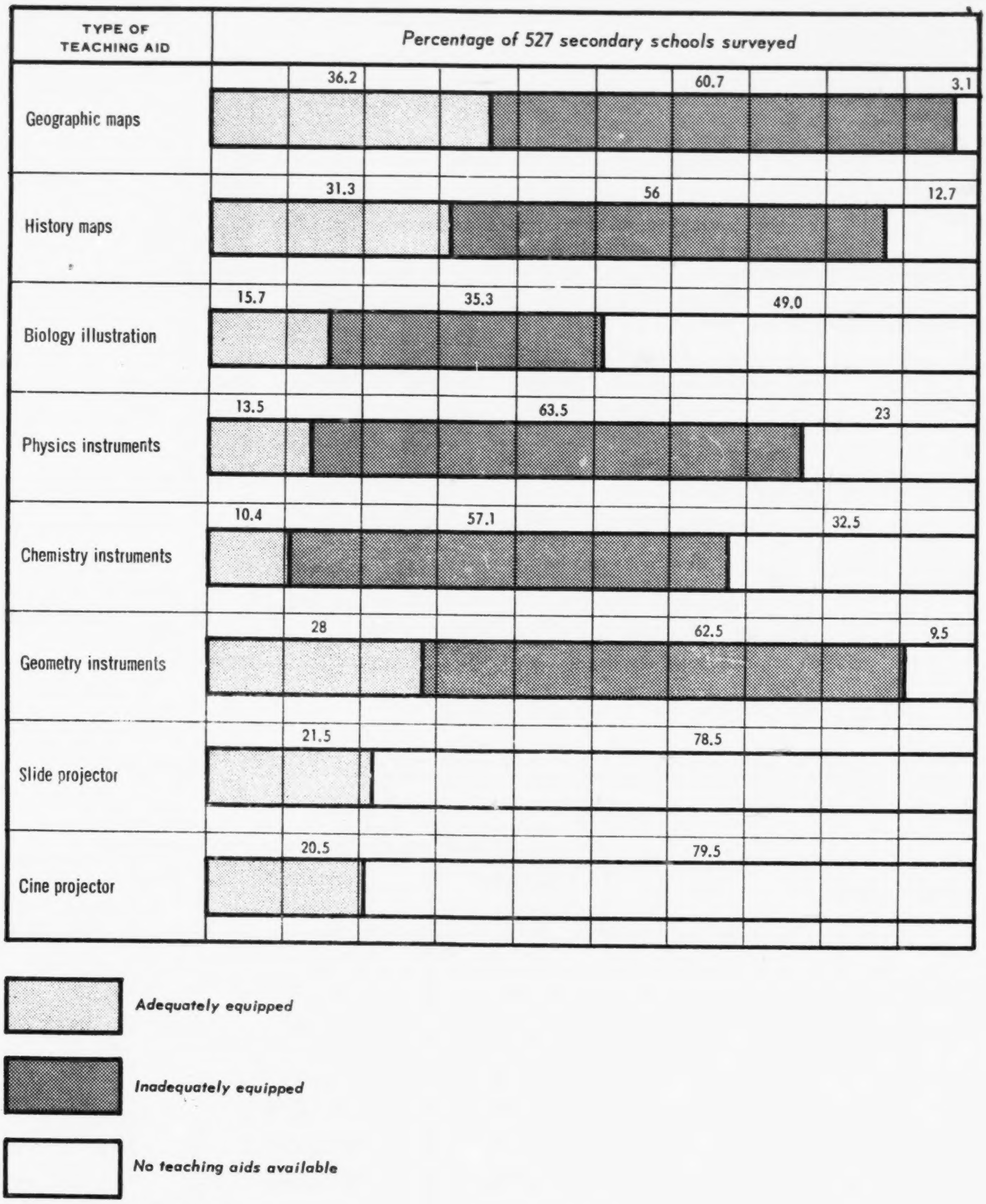


Notes: The chart reflects the percentage provided each year of six years needs in a period of acceleration in the United Kingdom's school building programme 1948 to 1953. The figures for DEEB countries are estimates of requirements over six years, distributed "exampli gratia" in the scale of acceleration achieved in the United Kingdom.

Acceleration in school building output United Kingdom 1948 to 1953

	Number of places required		
	Portugal primary	Spain ensenanza media	Yugoslavia primary
Total over 6 year period .	7,000	771,900	278,322
Average per year	1,166	128,650	46,387
Year 1	910	100,347	36,182
2	840	92,628	33,399
3	910	100,347	36,182
4	1,120	123,504	44,532
5	1,400	154,380	55,664
6	1,820	200,694	72,363

Table 12. SECONDARY SCHOOLS EQUIPPED WITH TEACHING AIDS (GREECE)



Results based on 1962 O.S.K. census.

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